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[OFFICIAL NOTICE.]

Bound Volume, Proceedings New England Association of Gas Engineers.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS,
OFFICE OF THE SECRETARY,
NEW BEDFORD, MASS., Oct. 26, 1901.

A limited number of copies of the "Proceedings" of the New England Association of Gas Engineers, for the years 1900 and 1901, remain, and single copies can be obtained on application to the Secretary, who will mail them on receipt of $2.

This volume contains several papers and the discussions thereon, and are of especial value for reference. The "Proceedings" of prior years will be published later, and the volumes will be of great value for any gas man's library. N. W. GIFFORD, Secretary.

BRIEFLY TOLD.

MR. LITTLEHALES RETURNS TO THE CHARGE.—Mr. Thomas Littlehales, writing to the JOURNAL, from Syracuse, New York, under date of Nov. 28th, has this to say:

To the Editors AMERICAN GAS LIGHT JOURNAL: When I read your "Briefly Told," in the issue of November 25th, I wondered whether I had been "talking in my sleep," or whether the writer of "Briefly Told" was not guided by his powers as a mind reader, rather than those of the reporter or critic, when he penned the following sentence in reference to my paper on "Retort Ovens:" "We will admit that Mr. Littlehales avers that the Syracuse form is the form above all others;" that is, the Semet-Solvay form of retort oven. Will you be kind enough to point out, for my enlightenment and for that of your readers, in what sentence of my paper I aver anything of the kind? Whether or not you have correctly diagnosed my own personal belief and convictions, as far as my knowledge of retort ovens extends, "is part of another question." I was specially careful in my paper, and in the discussion following it, to avoid expressing any such an opinion, and to confine myself to dealing with retort ovens as gas producers and their probable influence on the gas industry in the future, which a re-examination of my paper will prove, I think; and in my reply to some remarks of Mr. Alten S. Miller on that same line I specially repudiated the suggestion.

I have not a word to say against the severest criticism that may or can be put forward by yourselves or by my brethren of the gas fraternity. It is due to yourselves that you should do so, and due to the interests committed to your and their care that all new propositions and methods should receive the keenest criticism, which will be profitable to us all, and I therefore welcome it. I myself have followed that line too close in the past to be unprepared to *take* as well as *give*, and I shall "take" all my friends "give" me smilingly and with right goodwill, asking them, one and all, simply to "look before they leap."

Quoting Mr. Greenough, you repeat the inquiry, "What does the financial market say about the coke plant at Everett?" And you say: "We inquire further, how do the trustees of that concern feel over their painful duty in being obliged to make the next interest payment in December?" As an argument, or lack thereof, whichever you please, I

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may just as reasonably ask you to look over the stock quotations and note how many gas companies, whose shares in past days were gilt edged securities and at a high premium, which are now being quoted away below par; shares as low as 9¼ cents on the dollar, and 5 per cent. first mortgage bonds as low as 80 cents on the dollar, and this in large cities, too. And to ask you, Messrs. Editors, is this condition of affairs due to the present methods of gas making, or is it due to other causes; financial methods and operations for example? Is it not notorious amongst gas men that other considerations than the mere commercial ones of making and selling gas have operated on the Everett concern to put that establishment outside consideration when discussing the merits or demerits of the retort oven system of gas making; and this is a question entirely apart from the different kinds of ovens or of ovens versus retorts. Moreover, the Lower Province coal used at Everett is of such a sulphurous character as to preclude the coke therefrom being available for foundry purposes, for which retort oven coke, when made from a good American coal, is so eminently suited.

Defective hearing unfortunately prevented me getting the full purport of some of the questions put in the discussion, which questions in consequence did not receive the full replies that their importance entitled them; notably those of Mr. Addicks on the relative sulphur content of gas from ovens as compared with retorts. I stated that, as far as the sulphur was concerned: "There would be practically no difference in the sulphurous condition of the gas, in either the retort or the retort coke oven, when made from the same coal." This may need some qualification, perhaps. When speaking, I had in mind the better grades of American coals such as are generally used in gas making, and in such case I think my statement would be substantially borne out in general practice; but with a very sulphurous coal I can quite believe that the sulphur, being gasified at a lower heat than in the usual carbonizing temperatures (the sublimed sulphur being in contact with the heated carbon for a longer period in the ovens than in the retorts, in consequence of the greater depth of material through which the gases have to pass) may be partly converted into carbon bisulphide. This is, of course, only an opinion; as a matter of fact, in constant operation in various places with suitable coal the sulphur question is never one of importance.

Then, again, as to the ammonia question raised by Mr. Searle, and his fears of what would happen to the market with the extra production from retort ovens. Nature and commerce have great compensating and adaptive powers to changed conditions. I can look back to 1872, when there was not a single gas company in the United States recovering the ammonia as far as I know, although very shortly after that the Manhattan Gas Company, of New York city, put up tower scrubbers, which I believe was the first attempt in the direction of ammonia recovery in gas works on this side of the water; and in those early days of ammonia production there was far more difficulty in getting rid of that article than there is to-day, and not as good prices realized for it then as to-day.

Then, Messrs. Editors, your remark in reference to Syracuse is a logical and natural one, and indicates your belief, or rather gives a hint that missionary work (on retort ovens) should, like charity, "begin at home." Personally I admit that as a sound principle, and to watch its practical application would be quite interesting; but that also is "part of another question." One of the main reasons I presume of its non-application in this case is the fact that the Solvay Process Company, in several of its large manufacturing operations, finds a high grade gaseous fuel indispensable, the requirements calling for a much higher thermal quality than producer gas affords. And not only does it use all the surplus gas from its present ovens, carbonizing 180 tons of coal per day, but in addition makes and uses many millions of cubic feet per day of producer gas; and consequently, to do as you suggest, would mean a special installation of ovens for that purpose; and who knows, whether "the whirligig of time" may or may not bring it around?

Yours very truly, T. LITTLEHALES.

NOTES.—We are in receipt of a copy of the latest revised catalogue of the Bristol Company, of Waterbury, Conn., which clearly and cleverly describes the pressure and vacuum gauges manufactured by it, and that are so well known to the gas men. The catalogue covers also descriptions of pressure gauges adapted to all possible uses. The Company will forward the catalogue to any of our applying readers.—At the mid-November meeting of the Directors of the New Haven (Conn.) Gas Light Company no particular advance was made towards a final settlement of the plant betterments that are to be carried out next year on a large scale.

The Vienna Municipal Gas Works.[1]

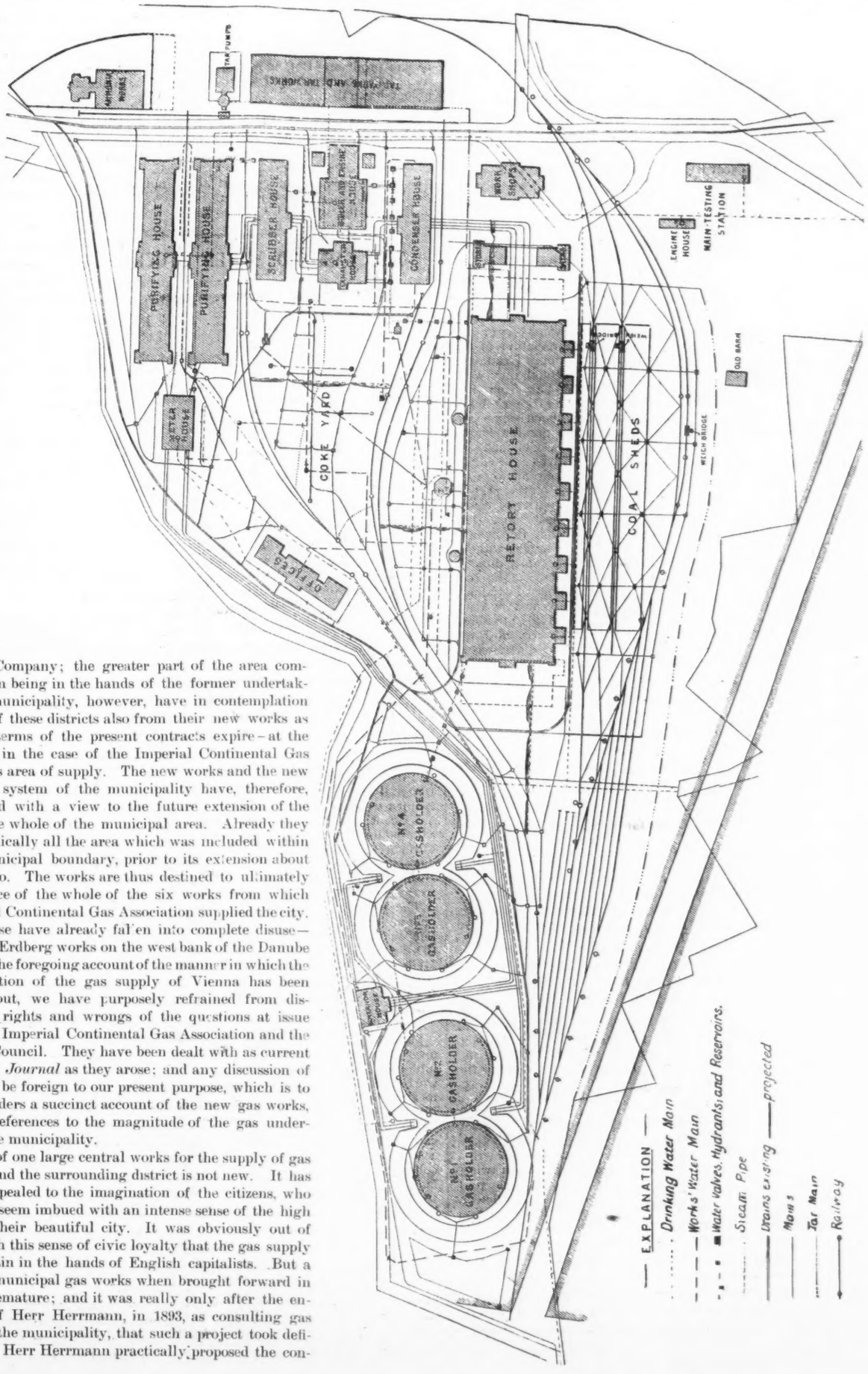
The Municipal Gas Works at Vienna, which came into operation in November, 1899, have already been described in the *Journal* by Herr Th. Herrmann, the engineer who was responsible for the plans to which they were constructed. As, however, the account which he gave was necessarily incomplete in some respects, and as a number of illustrations and plans of the works which were not then available, have since been put in our hands by the authorities of the city—whose courtesy we gladly take this opportunity of acknowledging—we offer no excuse for presenting readers of the *Journal* with the following description, which has been prepared mainly from the admirable *brochure* that was issued to all who attended the meeting of gas and water engineers in Vienna last June. This monograph—prepared by instruction of the Burgomaster of the city, Dr. Carl Lueger—is chiefly from the pen of Herr F. Kapaun, the engineer of the works.

A few words may be said, by way of preface, as to the circumstances which led up to the erection of these new works. Vienna had for many years been supplied with gas by two private undertaking—viz., the Imperial Continental Gas Association and the Austrian Gas Light Company. The latter, however, had assigned to it only a comparatively small district—roughly, about $\frac{1}{10}$ of the area now included in the city boundaries; and it continues to supply this district. The Imperial Continental Gas Association, on the other hand, concluded a contract with the municipal authorities in 1875 for the supply of gas to the remaining portion of the city, as from November 1, 1877, for a term of 22 years. The municipal boundary did not, however, then include a number of outlying districts, which have since been brought within it; and with many of these districts the Association made contracts terminating at a later date than the contract with the municipality. When these districts were absorbed in the municipal area, the Association maintained its right to supply them for the full terms of the contracts made, without regard to the earlier termination of its contract with the municipality. The authorities of the city had the option of terminating their contract under certain conditions at the expiration of 12 years—*i. e.*, in 1889; but though the question of the purchase of the Association's works or the erection of new works at that time was much discussed by them, the contract was ultimately allowed to run for its full term of 22 years—terminating on October 31, 1899.

Many years prior to this date, negotiations were entered upon for the purchase of the works of the Association by the city from that date; and at the same time projects for the erection of completely new works were discussed in the City Council. There appeared to be a consensus of local opinion that the time was ripe for the undertaking of the gas supply by the municipal authorities; and the question of a renewal of the contract with the Imperial Continental Gas Association for a further term of years was not seriously entertained. Ultimately also the purchase of the Association's works and mains was decided against; and in October, 1896, the city authorities definitely determined to erect new works and provide new mains for the supply of the area served by the Association from the date of the termination of the existing contract—*i.e.*, from November 1, 1899. The existence, however, of independent contracts, terminating at a later date, between the Association and districts which were at one time outside the municipal boundary, but had since been brought within it, led finally to an understanding between the Association and the city authorities. In effect it was agreed that, in consideration of impending litigation being dropped, the municipality would leave to the Association unquestioned the right to supply gas until the close of the year 1911, in the outlying districts on the west and northwest of the city. The municipality, however, would undertake the supply of the central and eastern portions of the city from November 1, 1899. The district supplied by the Austrian Gas Light Company, in the southwest, was unaffected by this arrangement.

In order to make clear the effect of this division of the gas supply from November 1, 1899, it may be well to point out that the city of Vienna now comprises 20 districts. The first is the Inner Town, in the heart of the place. This first district is encompassed by 8 districts—viz., the second to the ninth districts inclusive. To the southeast, and lying outside this first circle, are the tenth and eleventh districts, in the latter of which the new municipal gas works are situated. To the north is the twentieth district. The whole of the 12 districts named are now supplied with gas from the new works, which, therefore, already have a distributing system extending throughout the more central districts of the city and 3 of the outlying districts. The remaining 8 districts—all lying outside the first circle of the more central districts—are at present shared by the Imperial Continental Gas Association and the Austrian

1. *Journal of Gas Lighting.*



Gas Light Company; the greater part of the area comprised therein being in the hands of the former undertaking. The municipality, however, have in contemplation the supply of these districts also from their new works as soon as the terms of the present contracts expire—at the end of 1911 in the case of the Imperial Continental Gas Association's area of supply. The new works and the new distributing system of the municipality have, therefore, been planned with a view to the future extension of the supply to the whole of the municipal area. Already they supply practically all the area which was included within the old municipal boundary, prior to its extension about ten years ago. The works are thus destined to ultimately take the place of the whole of the six works from which the Imperial Continental Gas Association supplied the city. Some of these have already fallen into complete disuse—notably the Erdberg works on the west bank of the Danube Canal. In the foregoing account of the manner in which the present position of the gas supply of Vienna has been brought about, we have purposely refrained from discussing the rights and wrongs of the questions at issue between the Imperial Continental Gas Association and the Municipal Council. They have been dealt with as current topics in the *Journal* as they arose; and any discussion of them would be foreign to our present purpose, which is to give our readers a succinct account of the new gas works, with some references to the magnitude of the gas undertaking of the municipality.

The idea of one large central works for the supply of gas to Vienna and the surrounding district is not new. It has for years appealed to the imagination of the citizens, who one and all seem imbued with an intense sense of the high destiny of their beautiful city. It was obviously out of keeping with this sense of civic loyalty that the gas supply should remain in the hands of English capitalists. But a project for municipal gas works when brought forward in 1872 was premature; and it was really only after the engagement of Herr Herrmann, in 1893, as consulting gas engineer to the municipality, that such a project took definite shape. Herr Herrmann practically proposed the con-

struction of works for an annual output of 3,500 million cubic feet on the site of the present municipal works. He contemplated the erection of such a works in four independent sections; and the scheme ultimately adopted was substantially his. But it was not until the end of October, 1896, that the Municipal Council decided on the erection of new gas works, and the laying down of a new distributing system, to come into operation Nov. 1, 1899. There were thus exactly three years for the completion of the work. Plans had still to be discussed and settled before the work could be actually commenced. A committee were intrusted with full powers to carry out the whole of the undertaking in the most expeditious manner. On it sat the Burgomaster and other leading civic officers, with Herr F. Kapaun as constructing engineer, and Herr Th. Herrmann as consulting gas engineer. The plans of the latter had included *façades* of glazed bricks throughout; but the committee were compelled to give up this portion of his scheme, on account both of the difficulty of obtaining enough of such bricks in the time at disposal, and of the great cost. The whole of the plans had to be subordinated to the condition that the works and distributing system should be finished, tested, and ready for regular work, within three years.

The site selected for the works was some low land within the municipal boundary, on the eastern side of the city, and about 3 miles from the center of it. The main line of the Austro-Hungarian State Railway runs along one side of the land, and the municipal electricity works are now in course of erection on the other side of the railway line. The land abuts on the west bank of the Danube Canal, some distance above the point where it emerges into the Danube. The canal, however, is of little service to the gas works, owing to its rapid stream and the still more rapid stream of the Danube itself. The coal supplies are brought to the works entirely by rail—the line which runs alongside being in direct communication with the coal fields of Austria. The area of the site is nearly 71½ acres; but, as the plan shows, it is of awkward shape, and, moreover, is traversed by the main sewer for the 11th district, which runs parallel to the railway, at about 110 yards from it. This could not be built over. Hence the original plans had to be modified, and the buildings arranged as best suited the awkward site. The four gasholders and governor house were, therefore, put on the tongue of land towards the city; and the rest of the ground was roughly divided into two halves by the retort house, to the south of which were put the coal sheds, pipe stores, etc., and to the north the various machinery and purifying houses. A space was also left on this site for the coke yard. Between the railway and the sewer it was decided to sink the tar and ammonia wells, and erect the sulphate works.

The site was very low lying land; and, in order to avoid risk of its being flooded, it was necessary to raise the surface level by 5 feet on the average, and in some places by over 6 feet 6 inches. For this purpose 513,000 cubic yards of filling material had to be carted on to the site. This was a matter of some difficulty, as it had to be done while building was in progress, and the works' mains and drains were being laid. It was hoped that the material could be obtained from dredging operations on the Danube; but in the end it was found necessery to procure it from different parts of the city, and to bring it to the works in carts. A track of standard gauge was at the outset laid on to the works from the branch line leading from the State Railway to the Erdberg works of the Imperial Continental Gas Association; and by this means all the materials required for the erection of the new works were brought on to the site.

Provision had to be made for bringing on to the works, and storing, the necessary supplies of coal as required. The most suitable gas coal is obtainable from the coal fields of Ostrau and Karwin, in Moravian Silesia. The annual requirement of about 290,000 tons was intended to be supplied, by arrangement with the colliery proprietors, in about equal monthly deliveries. But it was necessary, in order that emergencies might be met, to provide storage accommodation on the works for the whole of the probable consumption during the months of November, December, and January—that is to say, for about 100,000 tons. The transfer of the coal from the State Railway line to the works was greatly facilitated by the fact that the line here is about 19 feet 3 inches above the level of the gas works. Herr Hermann's original scheme provided for an elevated railway running from the State line through a coal storage house built alongside the retort house. But the great cost of such an installation, and a desire to have greater choice in the manner of storing coal, and to avoid risk of fire spreading through it, led to this scheme being abandoned in favor of 3 sheds completely open at the sides and railways on the yard level. An incline of 1 in 50 connects these with the State Railway line. At the foot of the incline, the line diverges into 4 tracks, 2 of which run between the coal sheds, while the others pass at the back to a shunting yard having 12 tracks, from which lines lead to the coke yard and other parts of the works. The total length of the railway lines on the gas works is some 6,640 yards. Arrangements have been made with the State Railway for dealing with the gas works' traffic; and the scheme of lines on the works has been carried out accordingly. On the average, 63 trucks of coal are received daily at the works; but on some days the number has been as many as 160. The coal sheds referred to have a total covered area of 9,050 square yards, which is only about 20 per cent. of the area needed for storing the supply in question. The remaining coal is stacked in the open, in heaps 16 to 21 feet high; and the area thus occupied by it is about 36,000 square yards. There is ample space for an extension of the coal yard. Coal is conveyed from the store sheds and heaps to the coal breaking machines by means of a tramway of 24-inch gauge.

The municipal authorities have provisionally disposed of their make of coke by contract; and the breaking and sorting of the coke has, therefore, been left to the contractor, who has erected sets of breaking and sorting machinery in a temporary building. One set is driven by steam, the other by direct current—both supplied by the Municipality. The installation, however, must be regarded as only provisional, for the reason that it was thought best to defer making definite arrangements for dealing with the coke, and also to refrain from introducing machinery for conveying coal and coke until the extent of the requirements and the conditions had been fully realized by a few years' practical operation of the works. The experiences gained since work started are said to confirm the wisdom of this view. So, for the present, some of the most interesting adjuncts of a modern gas works are lacking at Viecna; and it was this fact mainly which led the correspondents of the *Journal* who visited the works in June last to describe them as being on the whole singularly disappointing. If the talked-of installation of coal and coke conveying plant, etc., had been already introduced, their adverse opinion would probably have been considerably modified.

[To be Continued.]

Experiences Encountered During the Alterations to Connections of an 80-Foot Diameter Water Gas Relief Holder and Tank.

[A paper read by Mr. T. Randolph Murray at the last meeting of the Southern District Association of Gas Engineers and Managers, London, England, Nov. 14th, 1901.]

Though opportunities for periodically examining the interiors of both large and small gasholders frequently occur, yet the following account of the emptying of the 80-feet diameter relief holder and tank, and of the subsequent alterations and enlargements made to the connections of the same, may not be without interest to the members of the Association.

The holder in question has been in constant use at the Tottenham works for upwards of 40 years, and since the year 1894 as a water gas relief holder. It has a capacity of 180,000 cubic feet, is constructed of 2 lifts, is provided with a guide framing of the cast iron column type, and calls for no particular description with regard to details of construction. The object in view when the emptying and cleansing were determined upon was the enlargement of the existing 12-inch diameter inlet and outlet connections, which had become too small for the volume of gas passed through the holder (some 2,000,000 cubic feet per diem). This resulted in a heavy back pressure being thrown on the generating plant, which became a matter for serious consideration, owing to recent extensions in that quarter. The 12-inch connections were put in when the holder was first erected at these works; and their inadequacy to deal with the water gas passed through the holder, when it was finally put to this use, points to the disadvantage of using existing small holders as water gas relief holders, unless the connections thereto are of adequate diameter, or steps have been taken to make them so.

It was decided in this case to replace the existing inlet and outlet connections with a 36-inch diameter inlet and a 24-inch diameter outlet main, respectively. It had been estimated that these would provide ample carrying capacity for any increased volume of gas which it might be necessary to deal with, in the event of the generating plant being still further augmented at some future date. The considerably greater diameter afforded to the inlet as compared with that of the outlet main was to enable it to cope with the intermittent rushes of warm gas coming over from the water gas plant, and by its ample capacity prevent the possibility of any back pressure.

Before proceeding to describe the ensuing operations, it must be preliminarily mentioned that the holder tank had been made temporary use of as a storage tank for water gas tar, and there were some 4 feet depth of this product contained at the bottom when emptying operations

were commenced. The first operation carried out was the pumping off of the tank water overlying the tar; and it had to be accomplished while the inner lift of the holder was kept afloat and in use, as long as it was possible to do so. This was done in order to avoid shutting down the water gas plant until the last moment, as it could not be well spared at the time. The suction pipe from the pump was inserted in the annular space between the inner and outer lifts. It was found that the water came over comparatively pure at first, and it was run away down the surface drain without our encountering any trouble with the local authorities. As soon, however, as the cup of the floating inner lift began to settle into the tar, the pump began to lose the water and draw on the tar. The water still remaining within the tank was dammed up there by the imbedded lift, and further pumping operations in that direction were found to be impossible.

Attention was then turned to clearing the tank of tar, and for this purpose one of the Drum Engineering Company's rotary pumps was pressed into service, and was found to answer exceedingly well. The suction was in this case lowered down nearly to the bottom, between the outer lift and the wall of the tank. The tar, when pumped, was rather more difficult to dispose of, and an attempt was made to get rid of it by loading it into barges at the Company's oil delivery wharf, situated on the Lea Navigation Canal, about 1 mile distant. In order to do this, it was decided to empty of "dead" oil the 2¼-inch bore pipe line running between the wharf and the oil storage tanks at the works, and by making a short connection from the holder tank thereto, utilizing this delivery for loading the barges down at the wharf.

The preliminary emptying of the pipe line was successfully effected in a somewhat novel manner. The section end at the wharf was allowed to dip into the river. The pump at that point was then set going, and the water so pumped was allowed to force the oil in the pipe line back to the storage tanks on the works, careful watch being kept to see that pumping operations at the wharf should cease at the critical moment, and that no water should be pumped into the tanks. The reverse of this process had, of course, to be carried out with regard to the removal of the water pumped into the pipe; the water gas tar, in this case, being allowed to act as the clearing agent, and the water discharging back again into the river.

The arrangement described was found to work well as far as the delivery of the tar at the wharf was concerned; but after one or two consignments had been disposed of in that manner we began to encounter trouble with our purchasers, owing to the percentage of water in each delivery proving abnormally high. This was no doubt due to the fact of the tar and water having been stored together in the manner described. It was also found that, at one stage of the pumping operations, owing to the lifts of the holder being slightly tilted out of the horizontal plane, due to a reason not then apparent, but which was discovered later, the tank water dammed up within the inner lift was apparently making its way through the tar and under the cup and bottom curb of the respective lifts, at the point where they were tilted highest, thus finding an outlet into the annular space between the outer lift and the tank wall, and mixing in a very large proportion with the tar lifted by the pump.

This means of disposal had therefore to be abandoned and recourse had to the coal stacks as receptacles for what still remained at the bottom of the tank. Previous experiments at Tottenham in this method of utilizing water gas tar have proved that a very substantial increase of illuminating power, and an increased make per ton, are undoubtedly to be obtained by the admixture. The appended table, which has been compiled from statistics covering two consecutive periods of 65 working days, each shows at a glance the increase of illuminating power and make to be obtained.

Averages of Results of Two Consecutive Periods of 65 Working Days each.

Tar used per Ton of Coal Carbonized. Gals.	Make of Gas per Ton. Cubic feet.	Illuminating power. Sperm Candles.	Gals. of Tar used per 1,000 cubic feet of Gas made.
5.15	11,093	15.13	0.46
Nil	10,758	14.35	....
Increase	335	0.78	

or an increase of about 1.69 candles per gallon of water gas tar used per 1,000 cubic feet of gas made. This high gas enrichment value to be obtained from the tar when so utilized is, it would seem, sufficient to warrant its regular disposal in that manner. There is, however, one considerable drawback, namely, the objectionableness of the resultant mixture, which has a strong tendency to adhere to the stoking tools, not to mention the garments of the stokers. It was, in fact, chiefly this objection that led to the discontinuing of the practice at Tottenham, after protracted and otherwise satisfactory trial. Since, however, the adoption of power stoking machinery at the above works, the objection just cited is largely done away with; and the sticky nature of the tar makes it a valuable agent for laying the coal dust, which, with power charging machinery fed with broken coal, is excessive, and is apt to become a source of considerable trouble. Moreover, the original price of 1¼d. per gallon for water gas tar is no longer obtainable, so that with tar at a selling price of only ¼d. per gallon and the above advantages enumerated, it would seem that its readoption as an enriching agent was becoming worthy of consideration.

The coal dust annoyance above alluded to has no doubt manifested itself from time to time to engineers who have power charging machinery in operation on their respective works. Stopped ascension pipes, arch pipes, and even clogged hydraulic mains are probably more largely due to this source than is generally credited, where such machines are in use. The admixture, therefore, when available, of water gas tar with the coal, as a means of combating this trouble, while at the same time benefiting both the make per ton and the illuminating power, may be commended to their consideration.

While the emptying of the holder tank was in progress, a problem for careful consideration presented itself, namely, the clearing or scavenging out of the "dead" gas contained in the inner lift of the holder, which would be fully charged therewith, owing to its having been kept afloat, and in use, during the tank emptying operations, as has been described. Among the adjacent buildings surrounding the relief holder are a boiler house and retort house, both within a radius of a few yards, not to mention the Cambridge main line of the Great Eastern Railway, which runs by upon the east side, equally close. Great care, therefore, had to be exercised in this part of the undertaking, to prevent the possibility of any ignition of the issuing gas and air, which would manifestly be of a highly explosive nature.

The method determined upon for the discharging of the contained gas was as follows: The bonnet of the valve for closing the outlet main from the holder, which valve was situated at a point in the main beyond the water gas exhausting plant, was to be removed and the valve disk pulled out A long rectangular wooden shaft, previously prepared for the purpose, and constructed to fit the rectangular top of the valve, was to be erected over the mouth of the aperture, to serve as a discharging shaft, for conveying the gases well above the roofs of the surrounding buildings. The manhole in the crown of the holder was then to be removed, and a long canvas tube of the same diameter as the manhole aperture, provided at its upper and lower extremities and at intermediate points with circular distending rings, was then to be lowered down, the tube being of such a length that the lower end reached to within a foot or so of the few inches of tar still remaining at the bottom of the tank. The ring forming the upper extremity of the tube was to rest round the exterior margin of the manhole, being made slightly larger for that purpose. This orifice was then to be covered with a sheet of fine wire gauze as a protection (on the Davy lamp principle) against a possible falling spark, the whole arrangement being well plugged down, round the edges, to the crown sheeting with some soft clay puddle. The upper orifice of the wooden discharge shaft on the outlet main was to be similarly protected.

The water gas exhausters, situated between the holder and the discharge shaft, as before described, were then to be run, drawing in air at the manhole in the holder crown. This air would find its way down the canvas tube to the surface of the tar, and, being of a higher specific gravity than the gas, would drive it upwards, "piston fashion," the gas being in the meantime drawn off at the outer pipe, beneath the crown. The outlet was conveniently situated diametrically opposite to the manhole, thus miniminizing the possibility of the air making a short circuit through the gas.

To Mr. A. E. Broadberry, the Company's engineer, is mainly due this ingenious device, which was adopted to prevent as far as possible the formation of an explosive mixture within the holder; and, as was afterwards proved by tests on samples of the issuing gas collected at the top of the outlet shaft, its action was, as nearly as possible, perfect.

As the pumping operations drew near completion, all preparations were made for as speedily as possible carrying out the final cleansing operations, and as the last tar that it was possible for the pump to lift was pumped out on a Saturday, it was decided to clean the holder of gas the following Monday. At this stage, however, we nearly encountered disaster. The Saturday night proved an unusually cold one for the time of the year, and Mr. Broadberry, on going round the works during the evening, discovered that the crown and side sheeting of the holder were dangerously bulging inwards, and to such an ex-

tent as to throw into sharp relief the lines of the crown trusses and the side stays within. He at once procured a handy spanner and slacked out the holding down bolts of the manhole cover in the crown, allowing the air to rush in and compensate for the contraction of the gas that had taken place.

This contraction had taken place so rapidly that the ¾-inch bore "vent cock" on the center of the crown had proved inadequate to maintain equilibrium. The rapid cooling of the gas within the holder was all the more remarkable, as the temperature of the gas taken at the top of the discharge shaft later on during the process of emptying the holder proved it to be distinctly above atmospheric temperature, and quite warm to the hand.

On the following morning it was decided, in view of the events of the previous evening, not to further delay operations, but to commence at once the emptying of the holder, as the air that it had been necessary to admit into the interior had probably formed a more or less explosive mixture with the gas. With the aid of two men who happened to be at work, the canvas tube was got into position, covered with the wire gauze and sealed down with clay, as previously described. It was found impossible, with the time and help available, to get the wooden discharge shaft into position on the top of the valve on the outlet main, so the bonnet having been removed, a short length of 18-inch steel blast pipe was placed vertically over it and made tight round the bottom with clay puddle. The exhausters were then started and an estimation made, from their delivering capacity per hour, as to what length of time would be theoretically necessary for them to effect the displacement of the gas in the holder. This was found to be about 2¼ hours.

The first sample of gas was taken after a lapse of 15 minutes' exhausting, and was collected in an aspirator close above the wire gauze covering the orifice of the discharge pipe. When ignited it burned with a perfectly luminous flame. This was followed at intervals of 15 minutes by similar tests; nor was there much depreciation noticeable until the final test, the gas for which was collected at the expiration of the time determined by the calculation. This burned with a distinctly non-luminous flame, and required some pressure exerted on the aspirator to keep the flame from flashing back and igniting the whole sample, thus betraying the undoubted presence of an explosive mixture at this stage. The final sample taken after the lapse of a further 15 minutes failed to ignite, showing that the scavenging operation was then complete. The exhausters, however, were kept running for a further period of 5 hours to insure a thorough ventilation of the interior of the holder and tank. Had it been known beforehand that the success of the scavenging operation was so assured, the "dead" gas within the relief holder would have been transferred to another holder, instead of being discharged into the atmosphere, periodical tests being made to determine the critical point at which the discharge should be diverted from the receiving holder to the atmosphere. A considerable volume of practically pure gas would have been recovered in this manner.

It had been observed for some time past that the lifts of this holder remained somewhat tilted when grounded on the rest stones, and the origin of the displacement had hitherto remained a mystery. A curious discovery was made relating to this, on entering the interior of the shell for inspection, on the following Monday, when it was found that a surface water drain discharged into the tank on the side adjacent to the retort house. This drain had been connected, at some forgotten period, with the fall pipes from the gutters of the roofs of the retort house and coal stores. The rainfall of years had washed down the fine coal dust and silt from the roofs to such an extent as to silt up that side of the tank sufficiently to throw the lifts appreciably out of the horizontal plane, as was before mentioned. The practice of turning surface water drains into gasholder tanks must, therefore, be condemned in the light of this experience.

The alterations to the inlet and outlet connections of the holder were in due course successfully carried out, a heading been driven through, beneath the dry well and the bottom of the tank, to facilitate the removal of the existing connections and the erection of the enlarged ones. This heading was afterwards filled solid with clay puddle. In addition to the gas inlet and outlet pipes, provision was made for pumping off any tar that may in future accumulate in the bottom of the tank. This took the form of a 6-inch diameter cast iron suction, carried down the well and beneath the side of the tank, terminating a few inches above the bottom of the interior. Further, provision was also made for pumping off the residual oil that from time to time collects upon the surface of the tank water, and which in the ordinary way is inaccessible. This took the form of two 2-inch diameter wrought iron suction pipes carried down and under the bottom of the tank in the manner described for the tar suction, but being extended up within the interior of the tank until they terminated 5 inches and 10 inches below the overflow level, respectively; the object being to utilize the longer of the two pipes to skim a comparatively thin layer of oil off the surface of the tank water, while the shorter would afford a means of pumping off a deeper accumulation. The differential lengths on the pipes also provide a means of gauging, to some extent, the depth of the condensed oil upon the surface of the tank water.

After the alterations to the holder connections had been completed, it was found necessary, owing to the necessity for further storage room, to put the inner lift of the holder to work, while there was, as then, only some 7 feet of water in the tank. This necessitated the displacement of a large volume of air before the lift could be charged with gas. The same device which had been employed so successfully during the emptying operations was again brought into use, the operation, this time, being reversed, the air in the lift being expelled by the inflowing gas, at the orifice of the canvas tube, which was lowered, as before, through the manhole in the crown.

Tests were periodically made on samples of the issuing air, and these were collected in the aspirator at the mouth of the manhole. Until the close of the operation, these samples, when tested, indicated the presence of a very small proportion of water gas, and quite failed to ignite, while samples taken at the "vent cock" on the center of the crown burned brightly from the commencement of the operation, proving that the stratification of the air and gas was maintained to a remarkable degree. This was further demonstrated in rather a striking manner, on pulling up the canvas tube, towards the close of the operation, when it was found that some 2 feet of the outer surface, from the bottom end upwards, was comparatively clean and white, while the remainder was stained with a brownish deposit of heavy oil vapors from the gas which had leaked through the texture of the canvas; this being no doubt the origin of the gas found in the earlier samples. The demarcation between the zones of stained and unstained tube was sufficiently pronounced to corroborate what had been previously indicated by the tests—namely, the comparative absence of diffusion between the strata of air and gas.

In conclusion, I must crave your indulgence for the tedium of this somewhat lengthy account, and while thanking you for your kind attention, trust that the experiences related may not be without some interest to other members present.

The Maywood Gas and Gasoline Engine.

Iron Age says that the gas and gasoline engine built by the Maywood Foundry and Machine Company, of Maywood, Ills., is of the vertical multiple cylinder type, with the crank shaft, cam shaft, rocker shaft, connecting rods and all main bearings and working parts inclosed in an oil-tight base and running in an oil bath which furnishes perfect lubrication to all parts, including cylinders and pistons. These important parts being thus oiled as long as a supply of oil is kept in the crank case, there is no danger of hot bearings from the carelessness of attendants. Being inclosed, these parts are free from all dust and dirt, are out of the way and require no attention except to see that all parts are tight and the occasional addition of oil to the crank base. The cams, cam and rocker shafts, igniter cams and rods are all easily accessible by removing the two front doors on the engine. The two rear doors give easy access to the main bearings and connecting rods.

The connecting rods and crank shaft are made of forgings, and are very heavy. The main crank bearings are of babbitt. The crank and wrist pin bearings are of phosphor bronze. The pistons have 5 spring rings. The tops of the pistons are removable for adjustment of the wrist pin bearings without the necessity of taking them out. The cylinders are very heavy and are made of close grained iron, with water jackets of ample size to secure proper circulation to keep them cool. The valve chests are securely bolted on the front of the cylinders and are so made that when the valve seats are worn they can be bored out and bushed. They are thoroughly water jacketed. The valves are of the direct acting poppet type. The igniters are operated by hardened steel cams on the cam shaft. They are thoroughly insulated and the points are of platinum-iridium and are very durable. The igniters can be removed for repair in a few minutes in case of accident. Current for ignition is obtained from an Edison-Lalande battery and spark coil, or direct from dynamo. It is preferred to connect them up with both battery and dynamo by means of a double throw switch, using the battery to start with and then switching to the dynamo as soon as the engine is in operation. This saves the battery and furnishes a ready means of knowing whether the igniters are working properly by the breaking of the circuit on the 3 or 4 incandescent lamps through which the current

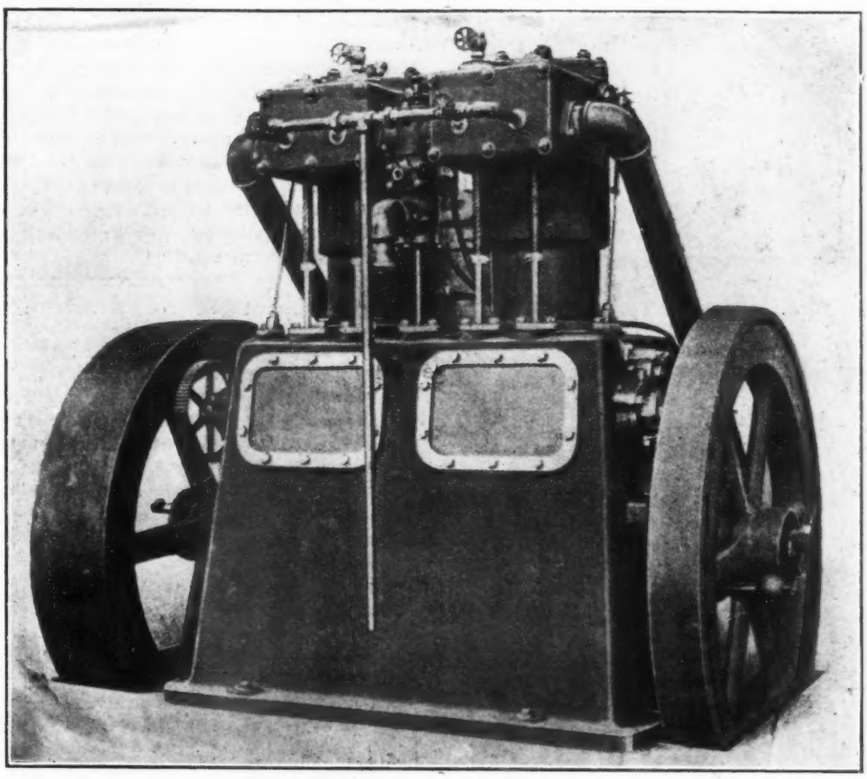


Fig. 1.—The Maywood Gas and Gasoline Engine.

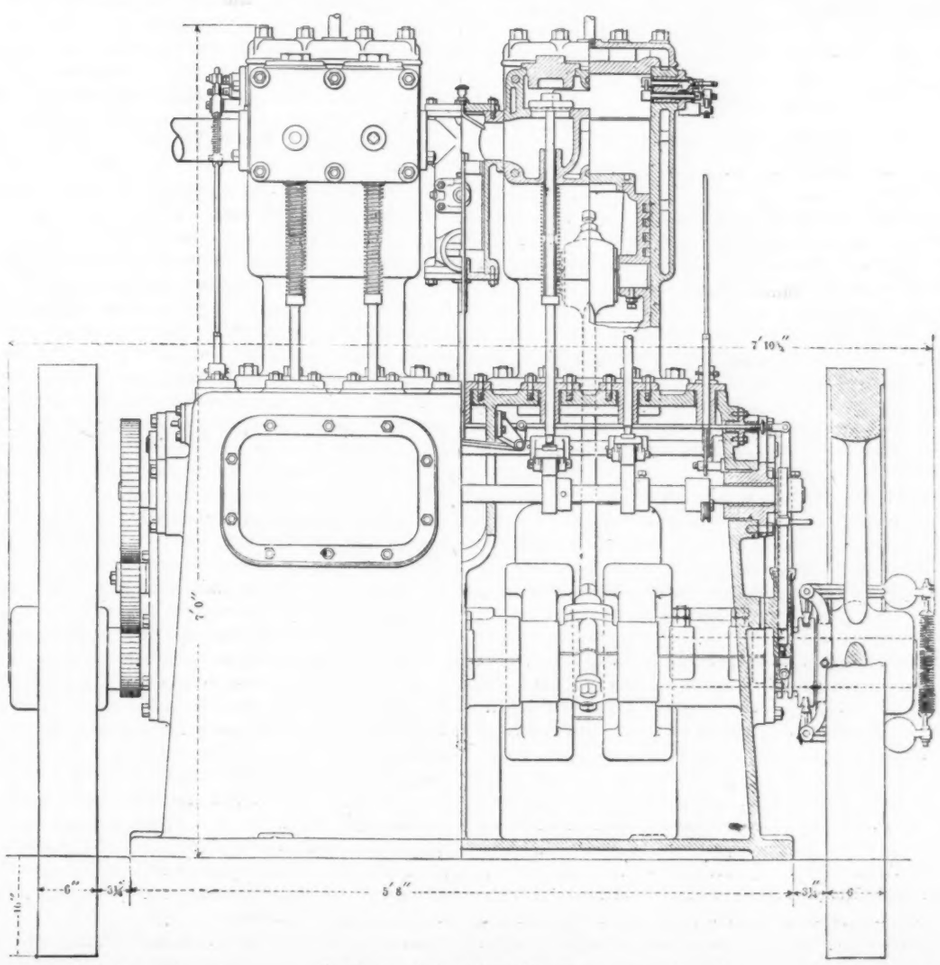


Fig. 2.—Sectional Front Elevation.

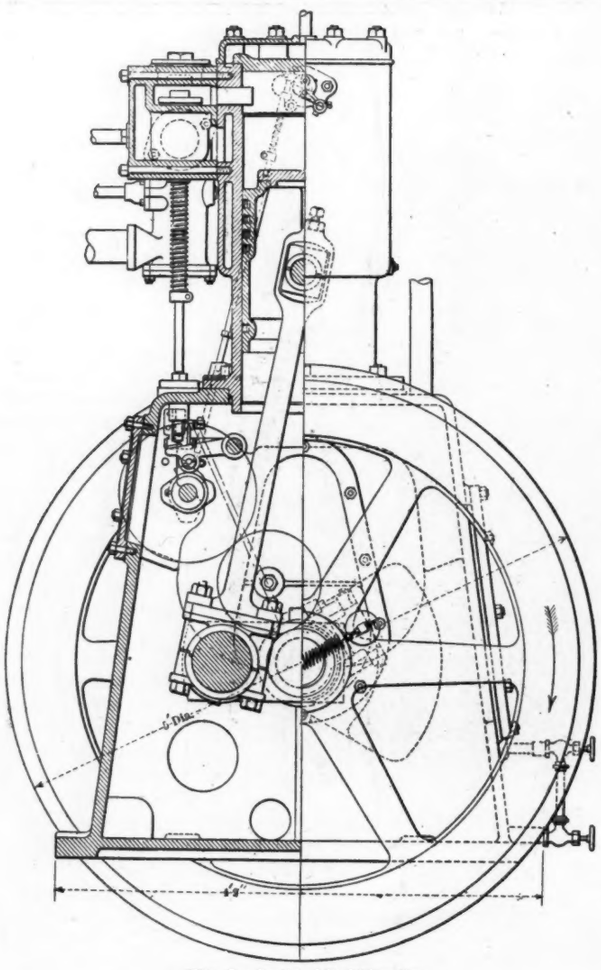


Fig. 3.—Sectional End Elevation.

passes. The flywheels are turned at the rims and hubs, making them run very smoothly and truly.

The gears which transmit power from the crank shaft to the main shaft are very heavy, are made of steel castings and are cut from the solid. A neat cover is placed over them to protect them from dust and dirt, and the possibility of anything falling into them.

The Maywood, being a multiple cylinder engine and operated with a throttling governor, takes a charge every revolution on the double cylinder, and a charge every ⅔ of a revolution on the 3-cylinder engine, The amount of fuel admitted to the cylinders and the force of the impulse are exactly proportioned to the requirements of the load. The governor is of the fly-ball type and acts directly by means of a lever and rod on the mixing chamber valve, through which both the air and and gas are admitted in definite and proper proportions to form a perfect explosive mixture. The motion of the lever and rod opens or closes this mixing valve as the load may require, and thus the exact amount of explosive mixture necessary to carry the load is at all times admitted to the cylinders, and so sensitive is this mechanism that it instantly responds to the widest fluctuations of load. Not only is great steadiness secured in this way, but the impulses being regularly given with every revolution and of much less intensity than in the "hit and miss" engine, there is avoided the severe shock and strain incident to the slowing down and sudden raising of speed. This prolongs the life of the engine and minimizes repairs. The proportion of gas or gasoline to air is regulated by a valve on the outside of the mixing valve and may be instantly changed and set anywhere so as to give from 1 portion of gas to 8 of air to 1 portion of gas to 20 of air, as the quality of the gas being used may require. A dial over which a pointer attached to the lever operating the gas valve moves, indicates the exact proportion.

Another important feature in the governing of the engine is the ability to regulate the speed while running. This is done by turning a little thumb screw on the governor rod, which increases or decreases the tension on the governor spring, and causes the governor to open a greater or less distance as desired. By this means the speed may be varied as much as 50 revolutions per minute without affecting the steadiness of the power. This, in case of a temporary overload, becomes very valuable, as the power of the engine is considerably increased by speeding it up. This should be done only in case of necessity, as the higher speed increases the wear on the engine.

These engines are so built that either gas or gasoline may be used, and if desired are furnished with both gas and gasoline inlet, so that a change can be made from one to the other while the engine is running; the only thing necessary to do being to shut off one valve and open the other. This feature is useful where the engine is being operated with gasoline in case anything goes wrong with the supply pipes or gasoline is unexpectedly exhausted.

The Present Outlook for the California Oil Industry.

By Mr. W. J. Young in *Eng. and Mining Journal.*

Never since the petroleum business of California reached the point of commercial importance have the conditions of the industry been so favorable as at the present time. There is not so much excitement as followed the discovery of oil in several new territories, nor does the general public watch the developement of the various fields with the feverish interest of a year ago, but the actual conditions that govern a great enterprise are steadily shaping themselves into businesslike form, where facts take the place of rumor and actual calculations assume the place of speculative predictions, where oil is measured in barrels rather than in the sanguine imagination of would-be producers; the consumer seeking the producers and the latter combining along the lines of the best economic administration of their work. Such in general terms are the conditions which obtain to-day as against the wild speculative rush of some two years ago.

In the matter of actual production of oil the highest point was reached in April of this year, followed by a decline which reached its culmina- in August. During this period a very unsettled condition of the industry prevailed. Since August there has been a steady increase in the development work of the various fields of the State and consequently in the output of oil. This growth has been slow and gradual. While the revival was not sudden, it is all the more encouraging on that account. The month of September showed a slow increase in the amount of development work done and all the while the different elements of the situation were being automatically adjusted so that the growth which has been registered since that time may be considered as permanent, bespeaking for the industry a continued steady improvement from this time on. October has showed a still better record of work, although not approaching the feverish and sensational rush of earlier days. The number of wells completed in October shows an increase of 41 over the September work, the increase of failures being but 3. The small ratio of failures may be attributed to the fact that the greater portion of work done was in the demonstrated fields, the territory of uncertain productiveness being for the time left in the background until such time as the petroleum market shall demand greater drilling efforts to supply its needs. This activity has been quite general throughout the State, and while as stated largely confined to the demonstrated centers, several wells have been brought in in the outlying districts. The most notable increase in drilling operations took place in the McKittrick and Sunset fields, while the southern fields lying in and about Los Angeles have shown more than their customary activity.

Back of this resumption of material activity lie several well grounded business reasons, the greatest of which perhaps is the combination that has been going on among oil producers. Chief among these is the combine of the Kern River oil men under the name of the Associated Oil Company of California. This corporation embraces a majority of the larger producers of the Kern River Field.

It was organized on a basis of a $40,000,000 capitalization, and is backed by some of the heaviest moneyed interests representing the petroleum industry. It has been a notable fact that since this combination the price of oil has advanced not alone in the Kern River and adjoining fields, but throughout the State; that long time contracts cannot now be made at figures which obtained some time ago. As an adjunct to the combine there will probably be built either a railroad or pipe-line to tidewater, thus placing the oil producers in an independent position as regards marketing their output. It is the opinion of those connected with the Associated Oil Company, and in fact of business men in general, that the institution will be equipped with such financial backing as will serve to enable it to meet all contingencies, and thus serve the interests which it is calculated to promote,

Another reason for the increased confidence and activity among oil men is the building of large refineries at several points in the State,

prominent among which are the projected refinery of the Union Oil Company in the Kern River Field, and the large refinery of the Standard Oil Company now in process of construction at Port Richmond. The building of a railroad in the Sunset District from Bakersfield has added not a little to the improvement of conditions of that prolific oil center. The combination of all of these forces will have for its ultimate purpose the development of the Kern county fields and a profitable disposition of their product. When this has been achieved it will benefit not alone the local interests which it serves, but the entire oil industry of the State, and will serve to stimulate activity in many of the outlying oil fields.

At Los Angeles, which is the commercial center for a number of well developed oil districts, the situation has been in an unsettled condition, owing to the long delay which was caused by the inability of the producers to combine upon a unanimous plan for marketing their product. Within the past two weeks this has been remedied to some extent by the suspension of negotiations between the Los Angeles Producers' Association and the Oil Storage and Transportation Company with the result that the producers have given up the association and have signed individually with the Storage and Transportation Company. By this means the oil of the local field will be marketed through one channel which will contribute largely to a betterment of prices.

Now that the year is drawing to a close, statisticians are beginning to figure their calculations as to the probable output of the State during the 12 months of 1901. Prominent among the calculations thus made are those of the California Petroleum Miners' Association which after having been submitted to a conservative revision has arrived at the following conclusion: The Kern River Fields are represented by 447 producing wells, averaging 60 barrels per day each, which gives a total production of 26,820 barrels per day, or 804,600 barrels per month. The output of the Sunset fields is figured at 70,000. Coalinga's output is figured at 300,000, and the Los Angeles fields are credited with 75,000 barrels per month. Former State Geologist W. L. Watts estimates the total yield of the State for the year at 7,000,000 barrels, and several other estimates have been made ranging between 7,000,000 and 7,500,000 barrels. According to the Petroleum Miners' Association these figures are too low, and the association gives as the probable output of the State 8,000,000, or double the amount of last year's production. In the writer's opinion, even this estimate will fall short of California's output for the year 1901. That this opinion is not unfounded may be gathered from the following table showing the amount of development work done during the past six months:

	May 31.	June 30.	July 31.	Aug. 31.	Sept. 30.	Oct. 31.
Wells completed	95	124	54	71	48	84
New productions	3,115	3,402	1,208	1,385	1,365	3,100
Failures	19	23	9	24	7	10
Rigs	221	66	45	38	48	93
Wells drilling	632	433	414	402	419	463
Total new work	853	499	459	440	467	556

A better idea of the amount of work in progress in the oil fields and its distribution throughout the State may be had from the carefully prepared table given by the Los Angeles *Herald*, reproduced herewith.

When it is considered that this represents merely the work of a single month it is plainly shown what the aggregate work of a year would produce.

With such an increasing production, one of the economic demands of the situation is a like increase of consumption, and an ideal adjustment would require that the one keep pace with the other. That this has not been the case heretofore has been one of the principal drawbacks from which the industry has suffered. It is but natural that such would be the situation owing to the newness of the oil industry and the educational work necessary to interest the consumers in the new fuel and enlighten them to its advantages. That the demand for oil is rapidly increasing cannot be denied. In San Francisco two years ago less than 1,000 barrels of oil were used during the entire 12 months, while to-day there are being consumed over 1,000,000 barrrls. If the market should expand during the next two years in like proportion (which of course is impossible) it would far outstrip the supply. The most accurate figures obtainable estimate that the railroads will use during the present year 4,000,000 barrels, and that the 4 big refineries operating in the State at the present time will absorb an additional 1,500,000 barrels. The total requirements of the State are placed at over 7,000,000 barrels. With the unbiased assurance which these figures give, there is not only room for encouragement among those interested in the oil industry, but the immense possibilities within their grasp are easily apparent. It would be profitless to attempt any forecast of the future, as the conditions which already govern are sufficiently strong to preclude anything but the best possible future for the oil interests in California.

Work in Progress.

Fields.	Sept. 30, 1901. Rgs.	Drg.	Tot.	Oct. 31, 1901. Rgs.	Drg.	Tot.
Shasta Co	0	4	4	0	4	4
Humboldt Co	0	4	4	1	3	4
Tehama Co	0	4	4	0	3	3
Glenn Co	0	2	2	0	2	2
Colusa Co	0	7	7	2	7	9
Butte Co	0	1	1	0	1	1
Napa Co	0	3	3	1	3	4
Solano Co	0	3	3	0	3	3
Marin Co	0	1	1	0	1	1
Contra Costa Co	0	4	4	1	4	5
Santa Clara Co	0	1	1	0	2	2
Stanislaus Co	0	2	2	0	2	2
San Mateo Co	0	3	3	0	3	3
Santa Cruz Co	1	3	4	3	3	6
San Benito Co	1	10	11	2	12	14
Fresno Co	4	14	18	4	18	22
Tulare Co	0	1	1	2	2	4
Kings Co	0	0	0	0	0	0
Kern River	20	*87	107	27	*96	123
McK.-Sunset	22	†98	110	17	†111	128
Monterey Co	0	11	11	0	11	11
Merced Co	0	0	0	0	1	1
S. L. Obispo Co	0	4	4	0	4	4
Santa Barbara	3	10	13	2	11	13
Summerland	0	1	1	0	1	1
Buckhorn	0	1	1	0	2	2
Fillmore	0	3	3	1	7	8
Santa Paula	2	12	14	9	19	28
Piru	0	10	10	0	10	10
Newhall	0	16	16	5	17	22
Los Angeles	2	32	34	6	30	36
Los Angeles Co	0	2	2	0	2	2
Whittier	3	17	20	4	24	28
Fullerton	0	32	32	5	30	35
Puente	0	3	3	0	3	3
Riverside Co	0	1	1	1	1	2
San Bernardino	0	4	4	0	4	4
San Diego Co	0	8	8	0	8	8
Totals	48	419	467	93	463	556

*Of the 96 wells drilling work is temporarily suspended on 19, leaving actual drilling in progress on 77 wells

†Of the 111 wells drilling work is temporarily suspended on 46, leaving actual drilling in progress on 65 wells.

Increase in new rigs	45
Increase in wells drilling	24
Total increase	69

Completed Work.

Fields.	Sept. 30, 1901—Wells. Completed.	Production.	Failures.	Oct. 31, 1901—Wells. Completed.	Production.	Failures.
Humboldt Co	..	..	..	1	40	0
Tehama Co	..	..	..	1	50	0
Santa Clara Co	..	..	..	1	40	0
Tulare Co	..	..	..	1	25	0
Solano Co	1	0	1	..	..	..
Fresno Co	8	200	3	3	120	0
Kern River	16	640	0	25	960	1
McK.-Sunset	5	190	0	17	680	7
Summerland	0	0	0	0	0	0
Santa Paula	1	30	0	4	270	0
Piru	1	30	1	1	30	0
Newhall	0	0	0	2	160	0
Los Angeles	9	100	0	13	575	1
Los Angeles Co	0	0	0	0	0	0
Whittier	2	60	0	2	60	0
Puente	0	0	0	0	0	0
Fullerton	3	115	0	3	210	1
San Bernardino Co	1	0	1	0	0	0
Riverside Co	0	0	0	1	30	0
San Diego Co	1	0	1	0	0	0
Totals	48	1,365	7	75	3,250	10

Increase in completed wells	27
" new daily production	1,885
" failures	10

Some Fundamentals of Electric Meters.

[Read by Mr. Caryl D. Haskins, at the last Meeting of the American Institute of Electrical Engineers.]

In preparing for presentation to the Institute my third paper on the general subject of recording meters, I have found it somewhat difficult to sift out from the vast mass of details a very few of the most vital considerations in construction and operation, which seem chiefly to merit consideration and discussion at your hands. It is the mass of individually trivial details which to-day constitute the chief field of study and investigation in electric metering.

The broader and more basic characteristics of the art have been widely discussed long since. Like the whole field of electrical engineering, recording meter design has progressed rapidly. A very few years ago our attention was given to such general issues as how to make a meter that would register on a dial, or how to make a meter that would not necessitate the winding of a clock, or how to make a meter that would record with tolerable accuracy through a range somewhat better than 4 to 1. To-day the art has reduced itself to what might be termed "A microscopic study of trivialities" purposed to gain such improvements as a few years since would have been regarded as academic; as, for example, better behavior on variations of wave form, an increase of 1 per cent. or less in average accuracy on loads of from 1 per cent. to 5 per cent. of the meter's rating, the maintenance of straight line accuracy on loads having power factors substantially unheard of commercially a few years ago, and the like.

This last consideration, that of accuracy on inductive loads, is one of the greatest importance, and has probably not received as much attention at the hands of meter engineers as it merits. I have not chosen to deal with it to-day, because it has been my desire in preparing this paper to lay a very few essentials before you in a thoroughly analytical manner.

To properly deal with meter accuracy under inductive loads, a paper should be devoted to this subject alone, and the subject would necessarily confine one to the consideration of alternating current meters only, a limitation which I by no means wish to accept.

Accuracy on inductive loads is unquestionably an absolute essential for all meters destined for use on alternating circuits carrying any other loads than incandescent lamps, but the elaboration of this topic before you to-day belongs more properly to my colleagues than to me.

I have chosen for my theme perhaps the most important of the considerations which are to-day engrossing the attention of meter engineers—namely, the relation between torque, friction, aging of various kinds and local surroundings. These four factors constitute the chief governing conditions in connection with meter accuracy, on loads of less than 20 per cent. of the meter's average rating. These considerations are, of course, confined to the typical motor meter. We have, however, long since come to regard the motor type of meter as the only electrical integrating device capable of being manufactured at a cost rendering it a commercial possibility, whilst retaining the degrees of reliability, convenience and accuracy demanded by the American market. It may indeed be fairly said that the considerations I have selected are the dominant ones in the American meter art. Substantially all of the motor meters known to the American market have a straight line law within their limitations, if friction be eliminated from consideration.

The limitations are, I admit, somewhat severe, but I am probably entirely safe in saying that the electricity meter, as the American purchaser receives it, is subject to a straight line law on non-inductive loads of the frequency, wave form and potential for which it has been calibrated.

Unfortunately friction cannot be eliminated, but its effect on accuracy may be minimized to a remarkable degree.

There is relatively little difficulty in producing a recording meter in which the effect of friction on accuracy is negligible even to a degree which may defy detection, at the time the meter issues from the laboratory. But friction causes are manifold and elusive, and I doubt if I overstate the mechanical situation when I say that a meter having the least evidence of friction in its initial condition may, at the end of a period of use, show more error due to friction and consequent light load error than other meters which had much more initial friction.

This is the abstract problem which lies before the engineer, and it has been met by numerous alternatives, all more or less effective.

Taking the next step in the analysis of the situation, we note that the motor element of a recording meter does two kinds of work: First, the driving of the dynamo in the form of a foucault current disk, or the equivalent—which is the work contemplated in the meter's theoretic law. The ratio of this work does not vary, provided the permanent magnets are literally permanent, except under physical conditions which can easily be provided for and guarded against. Second, friction work not comtempleted in the theoretic law, and therefore tending to distort the accuracy curve.

Friction is relatively unobjectionable so long as it remains a constant value, for as a constant value it can be readily compensated. The meter having X friction can scarcely be regarded as better than the meter having 10 X friction, provided these values do not change with time or load, a condition which we cannot unfortunately find in practice.

In seeking the alternative remedies for this condition three courses of study present themselves to us: The minimizing of friction as an individual study, means for increasing friction compensation with increase of friction, and finally, the radical increase of foucault current load in relation to possible friction load.

The two latter alternatives have always presented themselves to me as the most promising.

The dissipation of a relatively very large amount of energy in the foucault current disk renders wide variations of friction substantially negligible. In other words, if we can make the work contemplated in the law of the meter a large value, then the variations of work not contemplated in the law become insignificant in relation to the whole work. This means that we must dissipate in the foucault current disk the largest possible amount of energy consistent with economy. This statement, translated into practical terms, means permanent magnets of the greatest possible strength and a foucault current disk of the greatest possible conductivity consistent with the physical limitations.

The whole essence of success in a motor meter necessarily lies in literally permanent magnets. Since it is vastly easier to make a weak permanent magnet than a strong one, the temptation to get along without the dissipation of a maximum amount of energy in the disk is very great.

If one could make only very weak damping magnets, and therefore dissipate in the foucault disk a very small amount of energy, it would naturally become necessary to get initial friction very low to secure initial accuracy, and in doing this there is always grave danger of sacrificing a permanent minimum of friction to a temporary minimum of friction.

At this point the meter engineer must, if he is to follow the right path, become a physicist, a metallurgist, and, in some measure, a chemist; for he must make a deep and consistent study of strong permanent magnets, which involves a careful investigation of the chemical and physical properties of steel, and of the best means for introducing the initial magnetism, and of reducing this initial magnetism to the largest permanent residue that the magnet can be relied upon to retain. The shaping of the permanent magnets is also of the very greatest importance. How important you probably realize, for this subject has already been carefully dealt with in the most able essay by Dr. Kennelly.

Certain recording meters use a copper foucault disk in place of the more common aluminum disk. With a copper disk of a given thickness, moving at a given speed, more work can be expended in the generation of foucault currents with a magnet of given strength than with any other metal commercially possible. To substitute an aluminum disk having the same peripheral speed and the same thickness, means either to decrease the total work in the disk or to increase the strength of the permanent magnets. The latter is a desirable alternative which can possibly be achieved. The former is a highly undesirable alternative, for reasons which I have stated.

On the other hand, to substitute an aluminum disk of the some conductivity and purposed to rotate at the same speed as the copper disk, it is necessary to increase the thickness of the disk. This means that the jaws of the magnets must be further separated, if the clearances have already been reduced to a minimum. This, in its turn, means less density in the permanent magnets and less drag or load.

I have mentioned these tributary considerations to show the conditions which surround the work of the engineer whose purpose is to design a meter which shall expend a maximum proportion of total work in the foucault disk, and to show the chief danger in this direction of effort—namely, that of resorting to a magnet which may not be permanent.

Having achieved a meter mechanism in which the work expended in rotating the foucalt disk is relatively high, and having constructed a mechanism in which the *changes* of friction are a minimum, rather than a mechanism in which *initial* friction is a minimum, it is next necessary to provide means for immediately offsetting external conditions, which exert a modifying effect upon the friction value.

In the earlier days of meter operation it was regarded as desirable to reduce friction periodically to as nearly its initial value as possible by cleaning and the like.

It may be regarded as an axiom that friction will increase with use. This increase may be large or small in relation to the whole friction dependent upon design, and it may be large or small in relation to the total work of the meter, dependent largely upon the amount of work expended in the foucault disk.

All friction, however, as well as friction increases, is tributary to and governed by the conditions surrounding installation, and the chief of these external influences is vibration, though the literal results of time, consequent corrosion, etc., as well as changes of temperature, play their part.

The effect of vibration on the work value of friction is great, for perfectly obvious physical reasons, and this effect of vibration on friction becomes more prominent as the friction value increases in relation to total work.

It is, therefore, not sufficient that friction should be neutralized by compensation at an average point of calibration. It is important that ready means for variation of friction compensation should be provided, which can be instantly adjusted to meet the actual conditions surrounding the meter at its point of use. Such means for local adjustment have been provided in numerous forms, and are, I venture to think, highly necessary to the ideal electric meter.

Granting that the variations of friction load due to local surroundings can be accurately and quickly compensated by adjustment of the strength of friction compensation, every meter can be made substantially perfect for the point where it is actually to be used, without in any way affecting its total calibration.

It is well established that such friction increases as occur—due to use and surroundings—occur relatively early in the meter's life, the whole tendency being for the friction load to reach a substantially permanent condition after a comparatively brief period of service.

Instead of restoring the meter to its initial condition periodically by cleaning and the like, it becomes possible, where an adjustable compensation is available, to recompensate at the appropriate time for the permanent friction load, and thus restore the meter to a stable condition of equilibrium.

I have now laid before you the considerations which have led me to the conclusion that the two essentials meriting the most careful study in meter design are:

First, the expenditure of the maximum permissible amount of work in the foucault disk; and

Second, the provision of the best means for instantly compensating for friction variation at the point of use, without affecting total calibration.

The Possibilities of the Use of Coal Tar in Bituminous Pavements.

[By Mr. Fred. J. Warren, Boston, Mass.]

In judging of the possibilities for the use of any material it is best, if possible, to form an opinion based on practice rather than upon theory, and this is especially true when dealing with the bitumens.

The bitumens vary by insensible degrees from natural or artificial gas into the oils, malthas or tars and then into cements or pitches and passing the state of a cement into glance pitch or export pitch, and finally into a coke with no cementing property whatever.

The office of the bitumen in a pavement is to bind mineral particles together in forming a bituminous mortar or concrete.

It is quite evident at many points it is entirely unsuitable for use in pavement work.

Asphaltum and coal tar are names applied to impure bitumen, and the percentage of bitumen in any given crude or refined material varies greatly, and naturally the quantity to be used depends upon its purity; yet the purity has no relation to its quality, and in fact it is frequently the case that the non-bituminous matter native to a bituminous cement is quite essential to efficiency, and if not present naturally its equivalent must be supplied. According to the presence of the mineral, the component parts of the pavement mixture should be varied.

It should be understood that the best chemical authorities agree that bitumen has no fixed combination or composition of qualities, and that its nature and physical properties are as various as its source of supply It is simply a mixture of various hydrocarbons, and may be either a solid or a liquid.

Prof. Regis Chauvenet, one of the best mineralogists of to-day and President of the Colorado State School of Mines, has said: "Of course any person sufficiently skilled in manipulation can try practical experiments on commercial substances, but so far as analysis is concerned, I do not hesitate to say that I would not venture on the examination of a bitumen to pronounce on its value as a paving material."

Prof. Albert H. Low has said: "It becomes important to know to what extent a chemist can be of service in bituminous pavement construction.

"It may be answered that a chemist who has made a special study of the subject can, by proper chemical analysis and by certain physical tests, point out what is probably good or worth trying, but it is impossible to say it will be fully equal to one that has proved a success.

"Having learned by experience the chemical and physical differences between good and bad samples of any particular material, the chemist may thereafter afford valuable assistance in the use of that material."

I may add that my experience has been that chemists who have not made a special study of bituminous pavement construction can give no advice worth the having, and frequently give advice which is so misleading as to be worse than useless; but a chemist of training and experience in the business, or with the practical use of bitumen, can furnish certain chemical and physical conditions which are invaluable to those in charge of work, and without which it is impossible to accomplish good results on a large scale.

It should be considered:

1. That the physical condition of coal tar varies in its native state from different supplies, and

2. That its physical conditions can be greatly changed by refining and chemical treatment.

3. That it can be ruined by overheating.

4. That the manufacturers have used almost every grade of gas works' refuse without special treatment, and

5. That none of the modern methods of attaining exact uniformity of consistency of bituminous cement have been employed by the manufacturer in the yreparation of coal tar cements.

In the above will be found one, and the principal cause, of poor bituminous coal tar pavements.

It should be considered in addition:

1. That the manufacturers of the coal tar cements have not been terested in the laying of pavements and have had but little knowledge of the practical requirements.

2. That the contractors for the pavements have generally adopted hand methods, which would not accomplish uniformity.

3. The contractors have not followed the development in the grading and selection of the mineral aggregates.

4. They have generally been roofers, or others who have done business only locally, and have had a general or technical knowledge of the materials being used, and while all could distinguish great physical differences in the manufactured material furnished they had no way of improvement, nor sufficient interest to study the matter carefully.

The physical differences in the pavements grow out of all these conditions and pavements have been built, and are still being built, largely for sidewalks, with all grades of material, from limpid water gas or blast furnace gas tars to hard brittle pitches, with all, or practically all, of its life removed, and these varying materials have been used in all kinds of proportions.

The possibilities of the use of coal tar in bituminous pavements may be judged by the hundreds of small pieces of sidewalk pavements and many sections of roadway pavements in cities of this country which are in a good state of preservation after many years of use and exposure.

These samples may not represent 10 square yards out of 10,000 square yards that were laid more than 20 years ago, and in some cases over 40 years since, but they are of sufficient number and quantity to demonstrate the possibilities.

The large quantity of pavements in which coal tar or coal tar cements have been used and which have failed, or have partially failed, only illustrates the lack of knowledge, care and uniformity in the manufacture of the pavement and the preparation of the cement.

The making of bituminous pavement is a very complex matter, and one who undertakes to do good work without the aid of extended practice and records of conditions and results will find that variations of conditions which to him are entirely unnoticeable make a vast difference in results.

At this time the most expert bituminous pavers confine themselves largely to duplicating in detail the exact conditions which have previously produced good work, and spend large sums in keeping records of all conditions present, both from methods and grades of material used and by analsyis of the resultant mixture; while others without this expense often do good work by duplicating the proportions of the more careful.

The entire advance of scientific methods as applied to bituminous street pavements has been confined in the past almost if not entirely t›

the use of natural asphalt. This also applies to the manufacture of the bituminous cements.

If the bitumen used lacks cementing properties it fails to do its work properly. If the bitumen is too soft the pavement may be useless and will cut up and roll and will not sustain traffic.

If the bitumen is too hard it fails to be a cement or binding material in cold weather and cracking is liable to occur, and wearing takes place rapidly from the surface, in consequence of the mineral particles of the pavement becoming dislodged from its body by traffic.

This wear might also be produced by disintegration from water, or by the use of improper bitumen, or the cement may, and often is, ruined, or its life shortened by exposure in minute particles by use of improperly graded mineral grains.

In my study of the subject I have tried to avoid theories and have made an effort to detect and record conditions by a careful chemical and physical analysis of the pavements in use, paying as much attention to early failures as to those in use more than 20 years.

The recorded details are too voluminous for this paper, but furnish ample reason for the opinion that it is only a question of further recording of all conditions of construction and careful development to produce bituminous pavements with coal tar cements of great economic value.

The uniformity of the failures under certain conditions and the uniformity of the successes under other conditions is quite noticeable.

One condition quite contrary to the generally accepted practice in the manufacture of bituminous pavements is worthy of note, and that is that the very oldest bituminous pavements in this country have a coal tar cement as a base and have a coarser grain than has been used or considered proper in bituminous pavements, and all of them have a smaller percentage of voids in the mineral aggregate than is possible where only fine sand and stone dust is used.

Another notable condition is that none of the oldest coal tar pavements have a hydraulic concrete foundation.

An analysis of a large number of old and new pavements and a careful consideration of recorded conditions on the subject seem to justify the conclusion that the life of a bituminous pavement depends largely on the following conditions:

1. The proper selection of a good quality of crude bitumen.
2. The careful manufacture of the bitumen into a cement without overheating and by proper process which will not injure, but improve its physical properties.
3. The preparation of a cement of the right consistency to accomplish the longest life possible with the mineral aggregate used.

In determining the consistency of cement the following should be considered:

1. That the softer the cement the longer its life.
2. The coarser the mineral grain the greater rigidity produced by the grain itself.
3. The coarser the grain the fewer the voids, if the sizes are properly graded.
4. The fewer the voids and the coarser the grain the heavier is the bituminous coating where the same percentage is used.
5. The more thoroughly the surface is bound to the foundation the less liability of waving and, consequently, the possibility of using a softer cement.

It should also be understood that the life of the bitumen depends upon its use in a dense mineral mixture, and that no bituminous pavements have ever produced long life where the voids in the mineral aggregate were not practically completely filled with bituminous cement.

All bituminous materials are subject to evaporation, oxidizing or apparently drying on exposure, and the length of time which it takes to change the physical nature of the bitumen depends upon the condition of its exposure. If exposed in minute particles around the fine grain of sand, where, for instance, there may be a coat of less than 1-4000 of an inch in thickness, then on exposure the hardening of the coal tar cement would be so rapid as to cause a very short life; while, if the mixture is absolutely dense, the cement on exposure does not change its physical condition for many years except on the surface and acts as a permanent binding material.

If the above conclusions are correct, then a bituminous concrete wearing surface, using coarse particles of stone and thoroughly binding the wearing surface to the base which will hold it in place, will furnish the best tar pavement possible.

It should be understood, however, that a pavement which would be entirely satisfactory laid on top of a crushed stone foundation where the top would bind into the foundation, might, if laid upon a smooth concrete surface, slip and slide and prove absolutely worthless.

I have in mind a pavement which was laid recently by the company with which I am connected and where the surface mixture had been entirely satisfactory laid on top of a coarse rolled stone foundation; but the surface on a small section laid experimentally on top of a smooth foundation has waved to such an extent as to be very unsatisfactory. With the exception of the foundation, the methods and materials employed and the traffic conditions were identical.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, November 9th, 1901.

Some Advantages and Disadvantages of the Slot Meter System.—Possible Coal Trouble.—The Light of the Future is not a Success in the Streets.

The recent period of high prices in coal and iron, through which we have been passing, has had the natural effect of making gas works managers more cautious, and more critical in a financial sense, as regards new schemes of any kind. Some years ago, under very different conditions, there were those who did not object to the encouragement of invention and enterprise, as affording one way of reducing certain balances that were apt to get inconveniently large, but there is now no balance to play with, and the new departure receives but scant sympathy if it cannot justify its existence by standing on its own bottom from the first. An excellent example of this new style and attitude towards innovations is afforded by an article contributed by Mr. Geo. Helps to last week's *Gas World* under the title of "Some considerations respecting the slot meter system, and the suggestion of a hire purchase system for fittings, etc., as an alternative." The slot meter system is defined by the author as including the furnishing of all necessary fittings by the company, and putting a charge for the same upon the cost of the gas. But this, as I have pointed out before, is simply a usual feature but not an integral part of the system, and it is better for several reasons to draw a clear distinction from the first between the slot method of payment, and the supply of fittings free, that is to say, free of first cost. The slot system does not necessarily include the finding of anything beyond the meter, and on the other hand any amount of free fitting may be included in the ordinary system. Mr. Helps sums up the case for and against, scarcely with judicial evenness, and pronounces against it, that the disadvantages more than offset the advantages. But he bases his arguments upon an assumed annual average of only 9,000 cubic feet per consumer, and so far most of those who have applied the system to any extent will agree that he is correct, and that with such a low average the system is a failure. But instead of sitting down and uttering portentous jeremiads as to the future of those already heavily committed to it, they have taken up the more practical and businesslike line of working in the direction of increasing the 9,000 cubic feet to 15,000 cubic feet and upwards by the introduction of cheap cookers. It is not too much to say, in regard to many localities, that without the cooker there is no advantage to be gained from the system. According to the figures quoted, it appears that the user under the old system should pay 1s. 6d. more per 1,000 cubic feet for his gas in order to be fairly on all fours with the ordinary consumer, from which it would follow, since the usual idea of the correct extra charge is 8d. to 1s., that the slot consumer is unduly favored to the extent of 6d. to 10d. per 1,000 cubic feet. But when they are corrected to an average more in accordance with that obtaining in actual practice, a different result is arrived at, and it is shown that the accepted ideas are financially sound and correct.

The alternative suggested is that each applicant should pay a cash deposit or installment towards the cost of the fittings, and that the excess rate shall only be maintained until the balance has been covered. When this point is arrived at, the meter should be reset at a smaller excess, sufficient to cover meter rent and extra cost of collection, etc. For example, an applicant selecting £2 worth of fittings might pay 10s. down, and the meter might be set at 1s. 3d. excess, being 1s. for fittings and 3d. for meter rent, etc. As soon as 30,000 cubic feet is registered and paid for, he will have completed the purchase of the fittings which are considered to become his property, and the meter is set back to 3d. excess in regard to future consumption. This is simply harking back to the old story of cost per consumer as compared with cost per 1,000 cubic feet. A long service pipe, a wider or other accessory and the use of the consumer may be put in place of the fittings, and the obvious result is

that if any expense of this kind is lumped in as a part of the cost of gas, the user of a small quantity pays too little, while the large consumer pays too much. One consumer may use only 2,000 cubic feet per annum, while another uses 20,000 cubic feet on a similar lot of accessories, with the result that one pays 2s. and the other 20s. for similar utilities. The alternative offered converts a portion of the charge per 1,000 cubic feet with a charge per consumer, and so tends to reduce that kind of injustice. All who are interested in the slot system will do well to read and carefully study the paper, and those who have not as yet put it into practice to any considerable extent will be able to consider the desirability or otherwise of the alternative. Mr. Helps' views are freely discussed and criticized in an editorial note that appears in the same issue as his article.

There are signs of possible labor troubles in connection with the coal market, due to the somewhat inflated ideas held by the miners, or rather by those who are called their representatives, as to the possibility of controlling the prices and terms of sale. For some two years past the trade has been unusually good, and there has been a tendency to make any concession that will enable things to be kept going. On a falling market, however, things take a different complexion, and the owners are not inclined to work at a loss. The said representatives appear to be troubled with the delusion that the late "boom" was in the main caused and brought about by their artificial manipulations, and that the owners and merchants would sooner sell coal cheap. Recent events have come as a stern reminder that the labor representatives cannot and never did have any power in the way of permanently controlling the price of coal. Nothing short of a world-wide federation could do that. They have certainly managed to aggravate matters on one or two occasions, when famine prices were eminent, but only by adopting the reckless policy known as "killing the goose that lays the golden eggs." Up to the year 1899 the average British householder took very little interest in the matter of the price of coal, and always relied upon being able to get a ton or half a ton when he wanted it. The experiences of the last two winters have changed all this. After having been mulcted in famine prices during frosty weather, he now takes care not to begin the winter with an empty coal cellar, nor to overlook questions relating to economy in consumption, or the possibility of using gaseous and liquid fuels.

The representatives above mentioned would do well to note the eager demand for economizers for gas fires and for oil stoves, which shows that the patience and forbearance of the householder have been strained to their utmost limit. But yet the idea seems to be thattheremedy for a fall in price is to restrict the output. In South Wales a complete stoppage on particular days selected by the representatives, with a view of restricting in output and thus lowering stocks in hand, is now being practised. Several foreign buyers are already disgusted with the continual uncertainty that prevails in this district, and have directed their attention to other sources of supply, while home consumers are carefully studying every available means of economizing fuel, so this attempt to reverse the maxim of "small profits and quick return," if persevered in, cannot but lead to disaster, the full force of which will be felt by the men themselves. A reduced renumeration is a disagreeable dose to swallow. But the pendulum cannot always swing one way, and those who are eager to grasp every advantage with the rising tide, must be prepared to give away something with the ebb. So far as the supplying of gas coals is concerned, things are in a satisfactory position. Knowing the little ways of the miner's representatives, care is taken not to run the stock too low. Some are looking towards carburetted water gas, and it has been claimed that but for the existence of this alternative the gas coal market would have been yet more unfavorable to buyers during the past two years. However that may be, no one would care to be left to the mercies of the miner's representatives, absolutely devoid of any alternative. It is an ill wind that blows no one any good, and the growing dissatisfaction in regard to coal has greatly improved the demand for coke, with the result that the current value of this residual as compared with that of coal was never in a better position. In many towns the selling price of coke is 25 per cent. or so, with excess of the cost of coal at the gas works.

The incandescent gas light continues to make way and to replace electricity for street and public lighting. At Portsmouth, the electric glow lamps that have been tried in the streets have been alluded to, at a meeting of the Town Council, as failures, and the adoption of incandescent gas lamps was urged, in face of the fact that the electric works belong to the municipality. At Bristol, where similar circumstances prevail, the electric light undertaking belonging to the corporation, several streets have been lighted by means of arc lamps for some years, but the system is not being extended and trials of incandescent gas burners are in progress. At Bury, the original intention was to light the new markets by electricity, but a sub-committee, after full inquiry, recommended that gas should be used, and that a tender from the Welsbach Company to supply the lamps, etc., for £278 be accepted. The lowest electrical tender was £770 not including lamps. Some regret was expressed at the change, and Councillor Wilson said that the committee were staggered at the cost of electricity. The proposed scheme would afford a light of 28,000 candles at a cost of 2s. per hour, and the cost of providing it by means of electricity would be £3 3s. per hour. At Middleton, where the corporation have an electric plant, they put up 9 arc lamps in the streets, and in reply to an objection as to the cost, Councillor Wiggins admitted that the electric light was more expensive than gas, but said that as the corporation were suppliers of electricity, it would be a poor encouragement for other people to have the electric light if the Watch committee admitted that they could light the streets cheaper and better by means of gas. The Brechin *Advertiser*, referring to gas and electricity in the streets, says: "The palm is being awarded to the old light. Some of the gas lights are making the electric light appear but feeble flickers by comparison, and this is notably the case at the post office. At the door is an electric light, and a few yards away is a gas lamp, which irradiates the neighborhood and puts the new light of the future entirely in the background." A recent period of fog in London has directed attention to the utter uselessness of arc lamps at such times; and one of the Gas Referees has recommended that gas lamps ready for use should be kept in reserve in all the streets lighted by electricity. He has apparently overlooked the point that the lamps would cost about the same for maintenance and repair as if they were in regular use. A local paper, referring to some experiments at Canterbury, says: "Experience of incandescent electric lighting in public thoroughfares has been somewhat of a disappointment." At Torquay the electric light failed for half an hour in the middle of the evening, causing a great deal of inconvenience, and it is said that claims for damages will be made on the corporation.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. John S. Wilbraham informs us that the name of the Wilbraham-Baker Blower Company has been changed to read the Wilbraham-Green Blower Company. The offices remain as before at 2518 Frankford avenue, Philadelphia.

Among the betterments to the plant of the Morris (Ills.) Gas and Fuel Company, is a set of standard, Lowe water gas apparatus of the type supplied by the United Gas Improvement Company. The daily capacity of the set is put at 50,000 cubic feet.

Formal announcement has been made of the consolidation of the Port Jervis Light and Power Company, the Deer Park Electric Light Company and of the Port Jervis Gas Company, all of Port Jervis, N.Y. The name of the succeeding corporation is the Port Jervis Electric Light, Power and Gas Company, and it is to operate in the town of Deer Park, Orange county, N. Y., and in Pike county, Pa. It is capitalized in the sum of $400,000, and the main office is to be in Port Jervis. The Directors are: Ralph S. Weaver, Benjamin Ryall and W. A. Parshall, of Port Jervis; R. H. Beach, of East Orange, N. J., and C. R. Horn, of Catasaqua, Pa.

At the 32d annual meeting of the Ocean Grove (N. J.) Association, which was held in Ocean Grove the 22d ult., the proposition to establish a gas works there was postponed.

At the annual meeting of the Gilroy (Cal.) Gas Light Company, a dividend of 75 cents per share was declared. The following officers were elected: Directors, Amos Robinson, F. R. Chesboro, S. T. Moore, L. A. Whitehurst and M. Casey; President, Amos Robinson; Vice-President, S. T. Moore; Secretary, L. A. Whitehurst.

The Cincinnati Gas and Electric Company is planning for an important addition to the electric lighting branch of its plant.

The latest hint from Texas in our line is that certain St. Louis capitalists are about to apply for the right to construct and operate an opposition gas plant in Dallas. From our point of view it looks that Messrs. Schneider, O'Connor and Miller, of the Dallas Gas and Fuel Company, will be able to squelch effectually any proposition of that nature that may be brought to the attention of the authorities.

It is also asserted that Altoona, Pa., is to have an opposition company. The moving spirit in the "enterprise" is Mr. Robert Kerr, who is said to have quite a lively reputation in the named place.

The New York and Richmond Gas Light Company, Staten Island, N. Y., is to extend its service to and through the precincts of Prohibition Park.

Mr. Bernard C. Cobb, General Manager of the Saginaw City (Mich.) Gas Company, is no longer a bachelor. That change in his life occurred in Detroit, Mich., the morning of the 18th ult., when Miss M. E. Ellis, of that city, changed her name to his. May they ever happy be.

Messrs. G. Nortz, W. D. Milligan, John Foster and other associates are seriously contemplating the advisability of going on at once with the construction of the gas plant proposed for Guthrie, Ia.

Mr. F. A. Drury, Secretary and Treasurer of the Spencer (Mass.) Gas Company, denies positively that any foundation existed for the rumor that the concern was about to change hands.

The Madison County (N.Y.) Gas and Electric Company, with a capital of $200,000, has been incorporated to supply gas and electricity in Oneida, Canisteo, Oneida Castle and in the towns of Oneida and Lenox, Madison county. This Company is to be the operating concern of and for the companies recently acquired in the named section by Mr. W. T. Morris, of Penn Yan, N. Y., and his associates.

A correspondent incloses the following, from Spokane, Wash., under date of November 22d: "Our County Commissioners have made a new contract with the Spokane Falls Gas Light Company for supplying gas to the county buildings for another year, under the terms of which the payment for the service is to be $1.50 per 1,000 cubic feet, which is virtually a renewal of the rate for the past year. But the Company now agrees to keep the mantles, etc., in order, on the basis of a payment of $7.50 per month, with the understanding that if the cost of which upkeep at the end of the year is found to have been less than $90 for the year the excess is to be refunded to the county."

The proprietors of the Consolidated Gas Company, of Baltimore, Md., have arranged to extend the mains to the Hampden district of the city.

Mr. Eugene Koppitz, of San Jose, Cal., has succeeded Mr. Edward Shortridge as Manager of the electric lighting division of the trading of the Selma (Cal.) Light and Water Company.

Mr. A. L. Rice, of Selma, Ala., who is in charge of the reconstruction of the gas plant at Healdsburg, Cal., says that nothing will be spared in the course of the work to put the plant in every sense up to the gas using needs of the place.

Mr. Newton Swift is no longer connected with the Ann Arbor (Mich.) Gas Company.

A correspondent forwards the following from Riverside, Cal., under date of November 20th: "On the 16th inst. the papers were passed transferring all the property, rights, privileges and franchises of the Riverside Gas Company to the Riverside Light and Fuel Company. At the same time a trust deed was put on file transferring all the property of the Riverside Light and Fuel Company to the Orange Growers Bank, in trust, to secure the principal and interest on $75,000 worth of gold bonds. The deed of transfer from the Riverside Gas Company to the Riverside Light and Fuel Company includes lots 1, 2 and 19 of block 16, in White's addition, and lot 2 and a part of lot 3 of block 10, range 2. Also all privileges and franchises granted to the Riverside Gas Company by the city of Riverside, November 7, 1894. Also all other real estate and personal property now owned by the first party. The consideration was $1. This concludes the deal of which first mention was made by you several weeks ago, and effectually snuffs the Riverside Gas Company from all corporate existence, the new Company taking full possession and management of all the business thereof. The deed of trust places in the hands of the Orange Growers Bank all the property of every description now in the possession of the Riverside Light and Fuel Company, or hereafter to be acquired by that corporatton, to secure the principal and interest on the issue of $75,000 of 20-year 5 per cent. gold bonds. This covers the entire bonded indebtedness of the corporation. The document is signed and executed by George H. Dole and W. F. Jordon for the Gas Company, and by M. J. Daniels for the Orange Growers Bank. The deed requires that the proceeds from the bonds be used only in the acquirement of new gas properties and in the extension of the plant and other facilities of the Company. It is understood that from $25,000 to $50,000 of the bonds will be used immediately in taking up the old bonded indebtedness and in the establishment of an improved plant. The remainder will be held as a reserve fund for the extension of the pipe lines and other facilities of the Company as future needs may require."

The Peoples Gas and Electric Company, of Burlington, Ia., has been incorporated, with a capital of $200,000. The moving spirits in the concern seem to be Messrs. R. E. Sunney and George P. Townsend, of Chicago. It is further thought that the General Electric Company has considerable interest in the enterprise.

On November 21st two cases of importance in connection with the natural and artificial gas supply of Ohio were decided in the Supreme Court of that State. The opinions were announced by Justice Burket, Chief Justice Marshall failing to consider the arguments in that he is a resident of one of the cities concerned in the pleadings. Our summary of the opinions was obtained from the columns of the Cincinnati *Enquirer*. The Court said, in substance:

"The cases were styled the Logan Natural Gas and Fuel Company against the City of Chillicothe and the City of Newark against the Newark Natural Gas and Fuel Company. In the former case the city asked for an injunction to restrain the Company from collecting from the consumers who had signed contracts agreeing to pay more for gas than the prices fixed by a city ordinance. The Company began to supply Chillicothe in 1895. In 1900 the city passed an ordinance regulating the price to be charged for gas furnished by other than meter rates, and giving the consumer the right to elect as to whether he should purchase by meter or by 'flat rate.' This scale, the city claimed, was not materially different from the scale put in force by the Company 5 years before, which fixed the rate at 25 cents per 1,000 cubic feet, and fixed the price of meters, where meters were purchased by the consumer. The Company claimed that the rates fixed were less than the rates of 1895. Very little gas was furnished by meter, most of the contracts being for fires under a flat rate. After a few years the Company advanced the price, and the city passed an ordinance attempting to establish substantially the old rate. The Company ignored the ordinance, claiming that its contract of February 11, 1895, ran 10 years, and the city brought proceedings to enjoin the Company from charging an increased rate. The Company threatened to turn off the gas, but the lower courts allowed the city's injunction. This finding the Supreme Court reverses, holding that the original ordinance of 1895 is valid for 10 years. Considerable confusion seems to have arisen over a construction of Section 2479, originally Section 416, passed in 1869, which provides that in case the Council fixes the 'minimum' price at which it requires a company to furnish gas it shall not be lawful for Council to require the Company to furnish gas at a less price during the period of time agreed upon, not exceeding 10 years. As Council is not expected to fix the lowest price at which it shall permit a Company to furnish gas, the Legislature evidently meant maximum when it said minimum. The court holds that a Council has no power under Sections 2478-79 to compel a Gas Company, without its assent to the ordinance, to furnish gas in a manner and at a rate entirely at the option of the consumer; that an ordinance regulating the price of gas under these sections is not restricted by Section 1691, which provides that 'The Council shall not enter into any contract which is not to go into full operation during the term for which all the members of such Council are elected;' that when an ordinance regulating the price of gas under the above sections provides that it shall be in force from and after its passage and publication, etc., and also that the Company shall be entitled to charge at a certain rate for 10 years from a date later than the date of the passage and publication of the ordinance; that this provision, when accepted in writing by the Company, is valid and binding for 10 years; that Section 2485 does not apply to natural gas companies, and that when Council has fixed the price according to one standard and the same has been duly accepted by the Company, it cannot be altered without the consent of the Company within 10 years by fixing another standard which may affect the limit or price previously fixed. Section 2485, which the court holds does not apply to natural gas companies, is the anti-monopoly section.

(*Continued on page* 895.)

THE AMERICAN GAS LIGHT JOURNAL

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PROPRIETORS.

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ELBERT P. CALLENDER,
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MONDAY, DECEMBER 2, 1901.

(*Concluded from page* 894.)

It provides that it shall not be lawful for any Council to agree by ordinance, contract or otherwise with any person or persons for the construction or extension of gas works, which shall give to any person making such agreement the exclusive privilege of using the streets for conveying gas to the corporation, or which shall deprive the Council of the right to designate the kind of meter to be used, the inspection or regulation required or the quality of the gas to be furnished; nor of the right to purchase the works at any time within the existence of the contract. This section was passed in 1869, before natural gas was a fact r, or, of sufficient volume, at least, in heating and lighting to have a commercial value. It would seem, under this decision, that a Council may contract with one natural gas company to the exclusion of all other natural gas companies."

MESSRS. E. B. HAWKS, of Ann Arbor, Mich., and Charles T. Anderson, of Dowagiac, Mich., have been granted a franchise for the construction and operation of a gas works in Dowagiac. The named place is a post village of Cass county, Mich., and it is located on the Dowagiac river at a point 35 miles southwest of Kalamazoo. It is a busy manufacturing center, but its population does not exceed 4,500. It is on the line of the Michigan Central Railroad.

AT the annual meeting of the shareholders in the Consumers Gas Company, of Johnstown, Pa., the officers elected were: Directors, James G. Ellis, C. S. Price, W. B. Lowman, Joseph Morgan and John D. Roberts; President, C. S. Price; Vice-President, W. B. Lowman.

MR. H. C. SCOTT, President of the Wichita (Kas.) Gas and Light Company, declares that, when his scheme for its improvement has been carried out, Wichita will have as complete a gas works as there is in the West.

MR. JOHN C. SCHMIDT, of York, Pa., has purchased a controlling interest in the Gettysburg (Pa.) Gas Company. He proposes to rebuild the plant.

The Market for Gas Securities.

The market for city gas shares was very ragged last week, with a decided tendency towards lower figures. Consolidated was quoted at the close to-day at 219 to 220. No sensible reason exists for the decline. The Directors of the Company have declared the usual quarterly dividend of 2 per cent. It is payable the 14th inst. The books close the 3d inst., and will be reopened the 16th inst. Quotations for other city gas shares are strictly nominal. There is some demand for New Amsterdam 5's.

Brooklyn Union is inert as to trading, the perfunctory quotation for it being 211 to 215. Lacledes are stiffening in value, but dealings in the shares are few and far between. Peoples, of Chicago, has recovered some from its recent low point, and Baltimore Consolidated also scored a fair advance during the week. Washington (D. C.) made another upward move, going to 330 bid, with no stock offering under 335. Cincinnati Gas and Electric Company's shares are quoted at 102 to 102½, in spite of the fact that several large blocks of it were recently put on the market by people connected with the North American Company. The general market for gas bonds remains fairly firm, with good inquiry for the various issues for which the Peoples Gas Light and Coke Company, of Chicago, is responsible. Reports received by us from test points throughout the country show beyond a doubt that the industry as a whole is in a most prosperous condition, and that the planning for extensions next spring is on a huge scale.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

DECEMBER 2.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	219	220
Central Union, Bonds, 5's.	3,000,000	1,000	109	110
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	115	118
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	295	305
" Bonds	1,500,000	1,000	00	102
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co.				
Bonds, 5's	11,000,000	1,000	107	107½
Northern Union, Bonds, 5's.	1,250,000	1,000	106	108
New York and East River				
Bonds 1st 5's	3,500,000	1,000	111	115
" 1st Con. 5's	1,500,000	..	109	111
Richmond Co., S. I.	348,650	50	100	..
" Bonds	100,000	1,000	103	..
Standard	5,000,000	100	130	135
Preferred	5,000,000	100	150	155
Bonds, 1st Mortgage, 5's	1,500,000	1,000	118	..
Yonkers	299,600	500	120	
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	211	215
" " Bonds (5's)	15 000,000	1,000	119	119½
Bay State	50,000,000	50	⅞	1
" Income Bonds	2,000,000	1,000	.	75
Binghamton Gas Works	450,000	100	28	30
" 1st Mtg. 5's	500,000	1,000	95	96
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	11¼	11½
" " Bonds, 5's	5,250,000	1,000	80¾	81¼
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Central San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas & Elec. Co.	29,500,000	100	102	102½
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	106	107
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	60	65
Preferred	3,026,500	100	84	86
Consumers, Jersey City Bonds	600,000	1,000	102	103
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore	11,000,000	100	62	63
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	12	14
" Con. Mtg. 5's	380,000	1,000	79	83
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50		89
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	381,000	1,000	89	89½
" Inc. 5's	16,000	100	94	94½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	34	38
Fort Wayne	2,000,000	..	..	.
" Bonds	2,000,000	..	53	55
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	102	104
Hartford	750,000	25	245	265
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	60	66
" Bonds, 6's	2 650,000	..	99½	101½
Jackson Gas Co	250,000	50	67	70
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	94½	95
Preferred	2,500,000	100	102	.
Bonds	10,000,000	1,000	..	108½
Lafayette Gas Co., Ind	1,000,000	100		60
Bonds	1,000,000	1,000	48	55
Louisville	2,570,000	50	110	120
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	102½	108
" 6 per cent. scrip, due 1910	100,000	25	87	89
Montreal, Canada	2,000,000	100	182	184¾
Newark, N. J., Con. Gas Co	6,000,000	..	..	55
Bonds, 6's	4,600,000	..	..	103
New Haven	1,000,000	25	300	325
Nashville Gas Lt. Co.	1,000,000	100	110	..
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	99	99¼
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	46	46½
St. Paul Gas Light Co	1,500,000	100	60	63
1st Mortgage 6's	600,000	1,000	82	85
Extension, 6's	600,000	1,000	.	..
General Mortgage, 5's	2,465,000	1,000	86	88
St. Joseph Gas Co.				
" 1st Mtg. 5's	751,000	1,000	93	96
Syracuse, N. Y.	1,750,000	100	17	19
Bonds	1,612 000	1,000	91	93
Washington, D. C	2,600,000	20	330	335
First mortgage 6's	600,000	..	..	..
Western, Milwaukee.				
Bonds, 5's	4,000,000	..	107	108½
Wilmington, Del.	600,000	50	232	..

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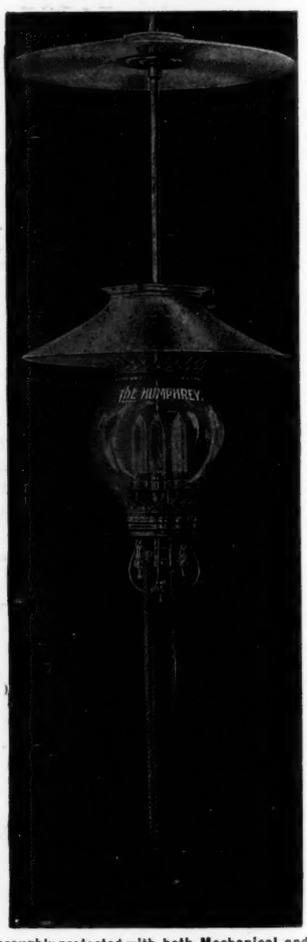

This lamp is thoroughly protected with both Mechanical and Design Patents. Imitation of this Design and Construction will be prosecuted.

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OFFICE OF THE AMERICAN GAS COMPANY,
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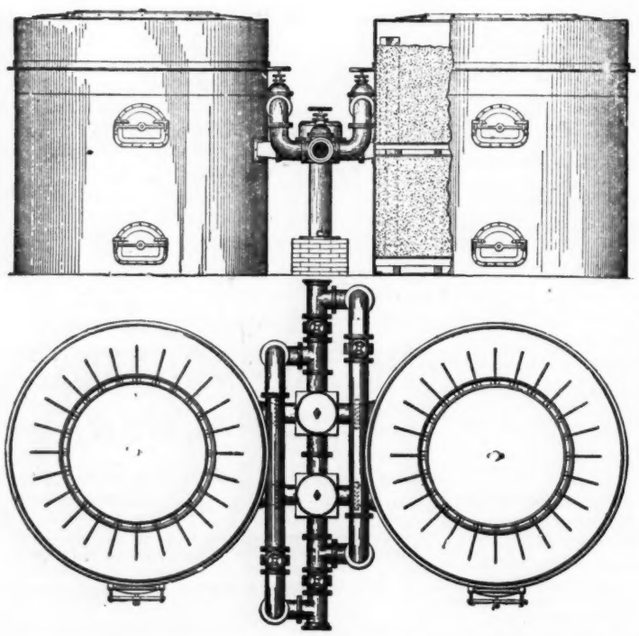

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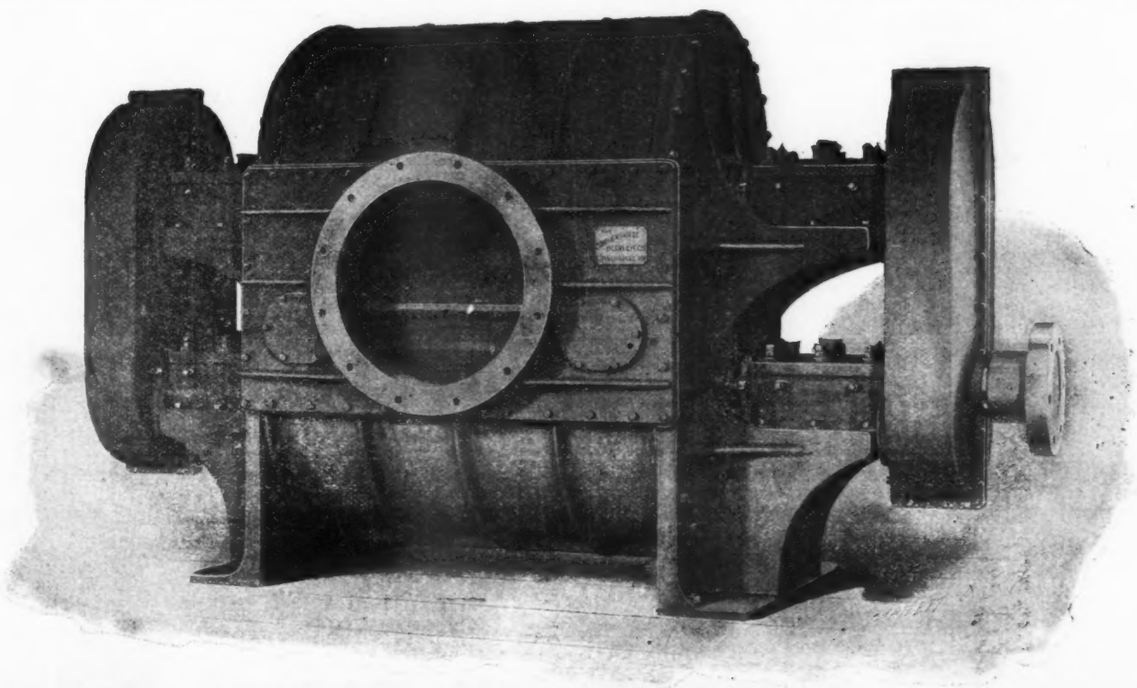

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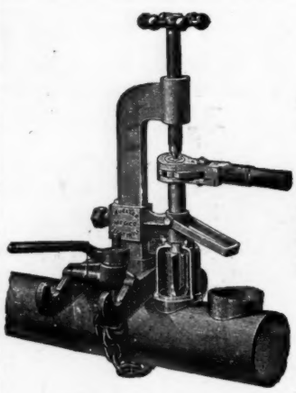

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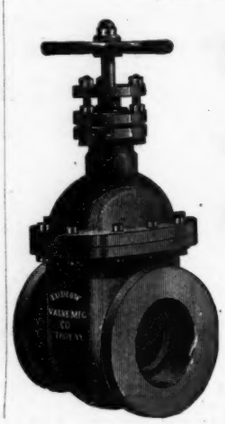

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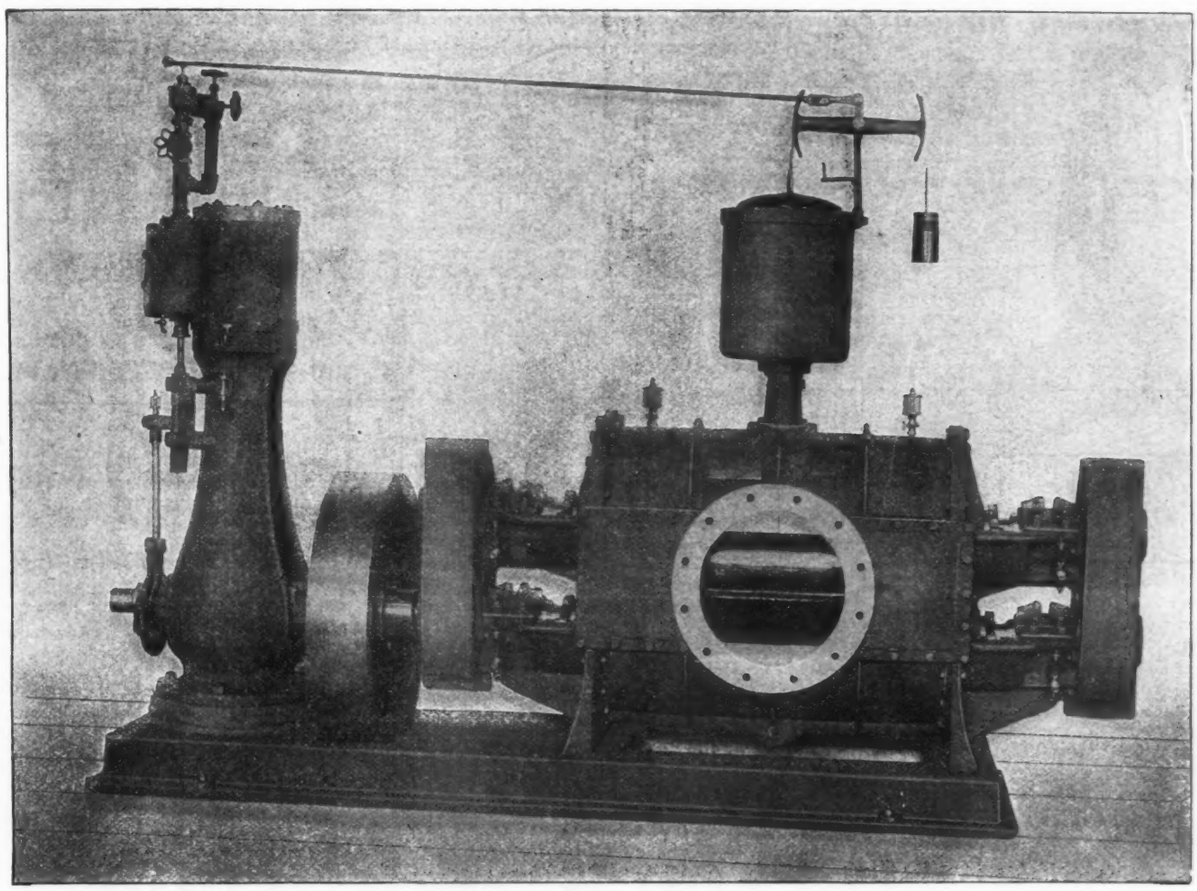

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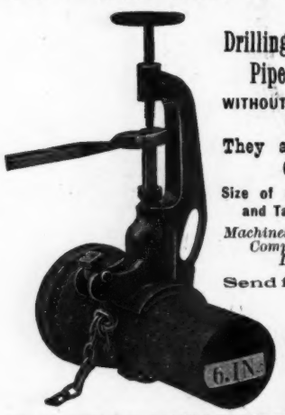

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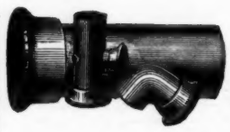

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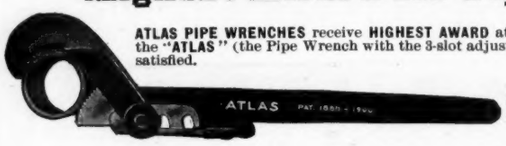

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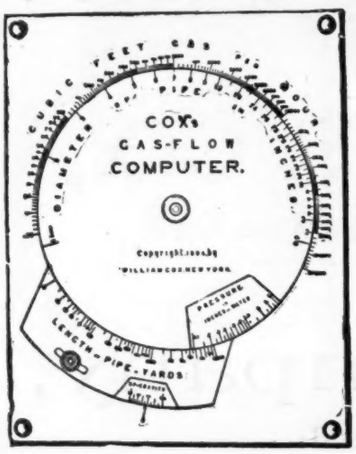

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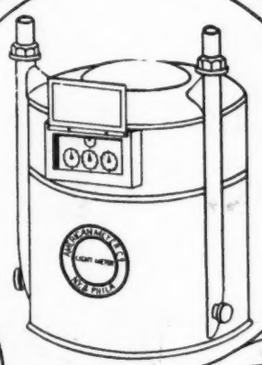

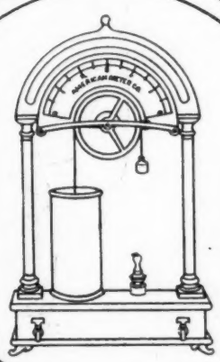

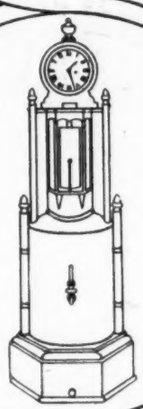

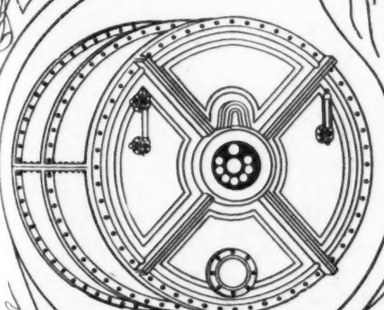

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NEW YORK AND PHILADELPHIA,

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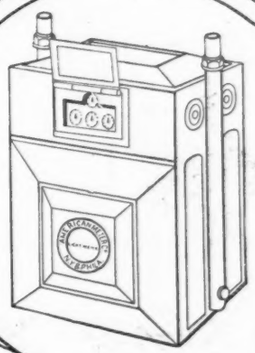
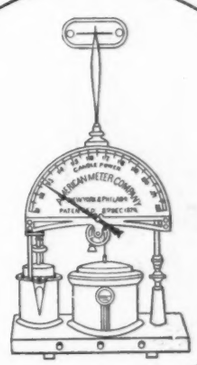
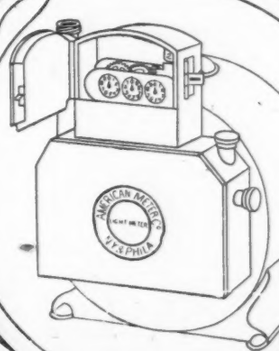






PUBLIC LIGHTING TABLE.

DECEMBER, 1901.

Day of Week.	Table No. 1. FOLLOWING THE MOON. Date.	Light.	Extinguish.	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light.	Extinguish.
				P.M.	A.M
Sun.	1	5.00 PM	12.00 PM	4.20	6.10
Mon.	2	5.00 LQ	1.00 AM	4.20	6.10
Tue.	3	5.00	2.00	4.20	6.15
Wed.	4	5.00	3.00	4.20	6.15
Thu.	5	5.00	3.50	4.20	6.15
Fri.	6	5.00	4.50	4.20	6.15
Sat.	7	5.00	6.10	4.20	6.15
Sun.	8	5.00	6.10	4.20	6.15
Mon.	9	5 00	6.10	4.20	6.15
Tue.	10	5.00 NM	6.10	4.20	6.20
Wed.	11	5.00	6.10	4.20	6.20
Thu.	12	5.00	6.10	4.20	6.20
Fri.	13	5.00	6.10	4.20	6.20
Sat.	14	5.00	6.10	4.20	6.20
Sun.	15	8.10	6.20	4.20	6.20
Mon.	16	9.10	6.20	4.20	6.20
Tue.	17	10.20	6.20	4.20	6.20
Wed.	18	11.20 FQ	6.20	4.20	6 20
Thu.	19	12.30 AM	6.20	4.20	6.20
Fri.	20	1.40	6.20	4.20	6.20
Sat.	21	2.50	6.20	4.20	6.20
Sun.	22	4.00	6.20	4.20	6.20
Mon.	23	5.10	6.20	4.20	6.20
Tue.	24	No L.	No L.	4.20	6.25
Wed.	25	No L. FM	No L.	4.20	6.25
Thu.	26	No L.	No L.	4 20	6.25
Fri.	27	5.10 PM	8.30 PM	4.20	6.25
Sat.	28	5.10	9.40	4.20	6.25
Sun.	29	5.10	10.40	4.20	6.25
Mon.	30	5.10	11.50	4.20	6.25
Tue.	31	5.10	12.50 AM	4.20	6.25

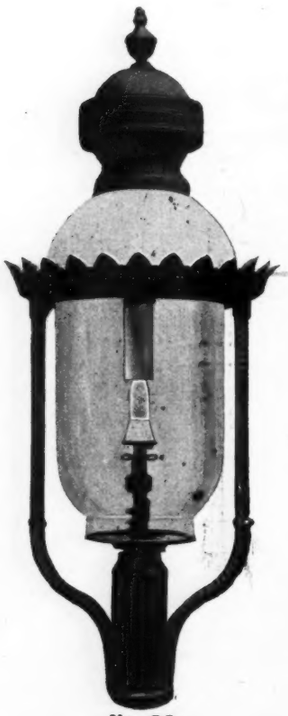
TOTAL HOURS LIGHTING DURING 1901.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	220.10	January	423.20
February	192.30	February	355.25
March	180.00	March	355.35
April	158.30	April	298.50
May	140.40	May	264.50
June	135.40	June	234.25
July	138.00	July	243.45
August	156.20	August	280.25
September	174.40	September	321.15
October	202.30	October	374.30
November	220.40	November	401.40
December	241.30	December	433.45
Total, yr.	2161.10	Total, yr.	3987.45

NEW YORK, 33 Nassau Street. PHILADELPHIA, Broad and Arch Streets. CHICAGO, Foot of Orleans Street. BOSTON, 624 Tremont Building.
CLEVELAND, 809 Cuyahoga Building. ST. LOUIS, 712 Roe Building. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 36.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

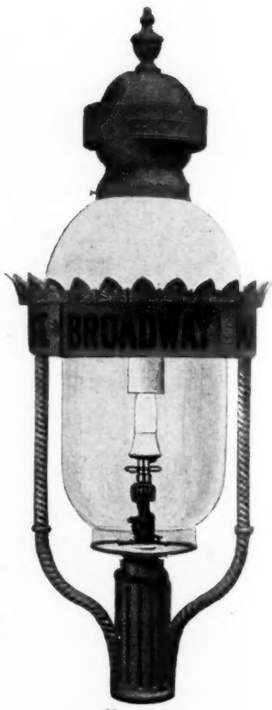
POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others Interested in Municipal and Outside Lighting.



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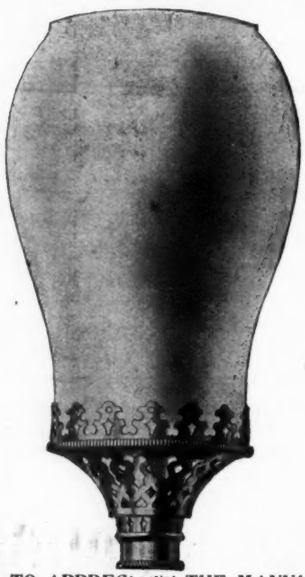
UNIVERSAL WELSBACH BURNER.

The most practical, efficient and artistic burner yet produced. . . . . .

It contains an improved adjustable Bunsen so constructed as to permit of a wide range of variations in gas pressure without blackening the mantles and without an adjustable air shutter. . .



It can be used with all styles and sizes of glassware, either shades or globes. No further necessity to carry a stock of different burners for the many sizes and shapes of glassware.

GAS COMPANIES AND DEALERS CANNOT FAIL TO APPRECIATE THE MANY SALABLE FEATURES OF THIS NEW BURNER.

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THE STANDARD DOUBLE SUPERHEATER
LOWE WATER GAS APPARATUS.

The capacity of apparatus installed, if operated continuously, is sufficient to make more than the entire amount of artificial gas annually sold in the United States.

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Established 1858. Incorporated 1890.
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H. D. ABERNETHY. Sec.

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Water Gas Cupola Linings, Fire Clay, Etc.

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In Kegs, 100 to 200 " " 6 " "
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OAKHILL GAS RETORT & FIRE BRICK W'KS

Our immense establishment is now employed almost entirely in the manufacture of

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We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We construct

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Containing 6, 8 or 9 Retorts.

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MANUFACTORY AT
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Clay Retorts, Blocks & Tiles

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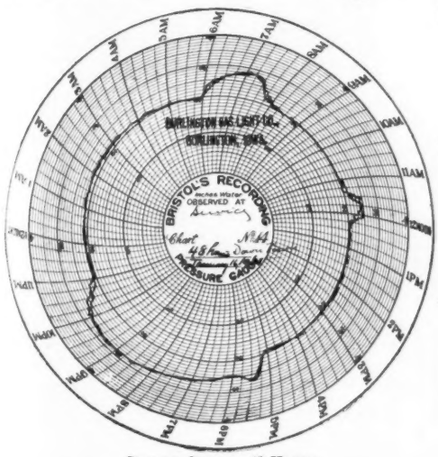
Particularly a CONNELLY Gas Governor,

Is as essential to the operation of a gas works as the Governor of any of our great States is necessary to the successful working of one of these political bodies.



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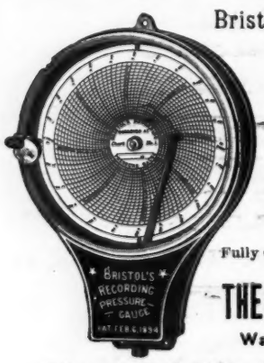

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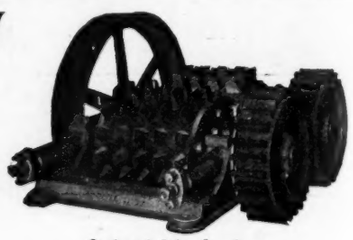
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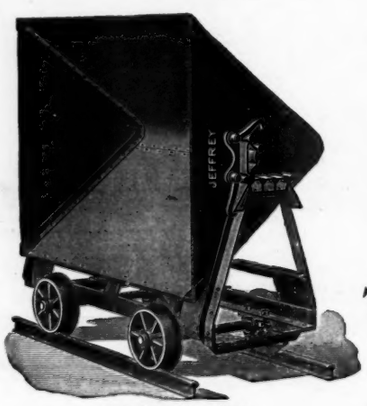

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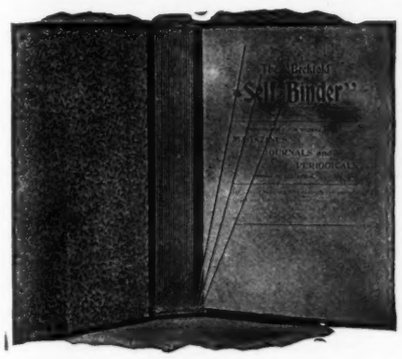

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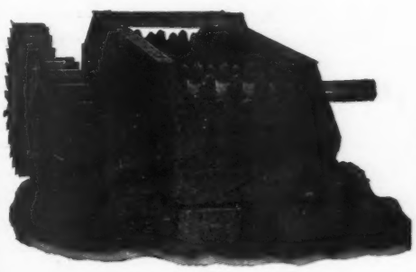

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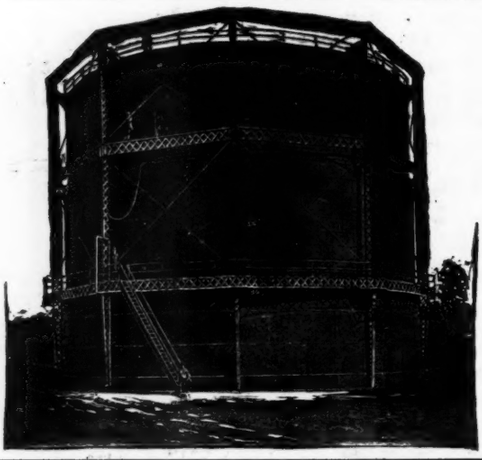

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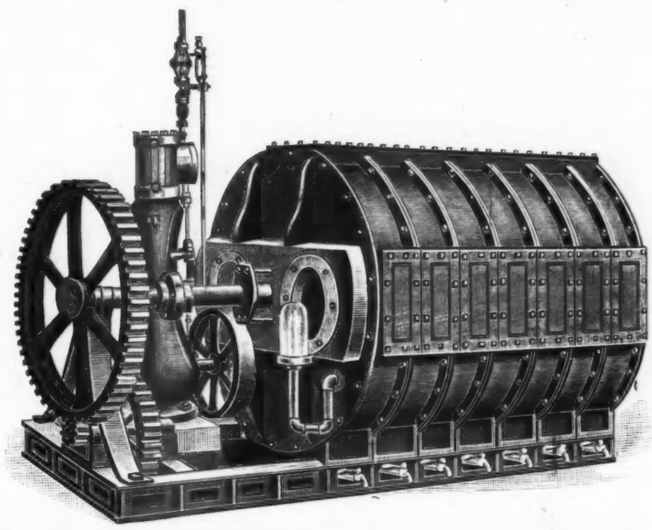

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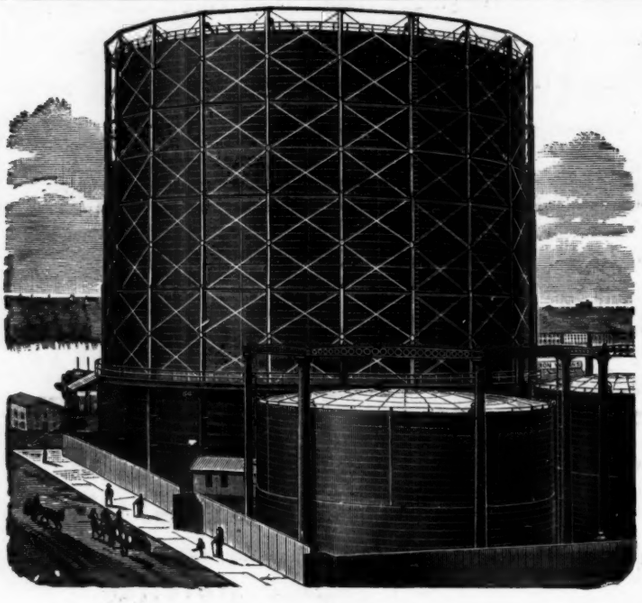

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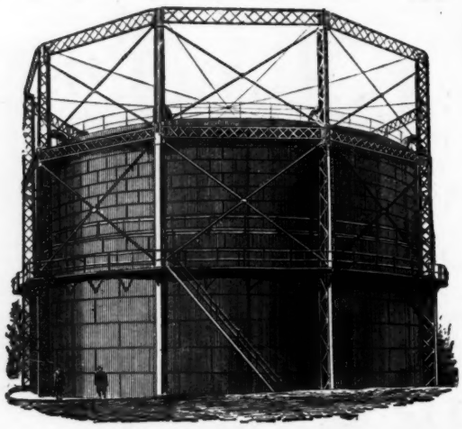

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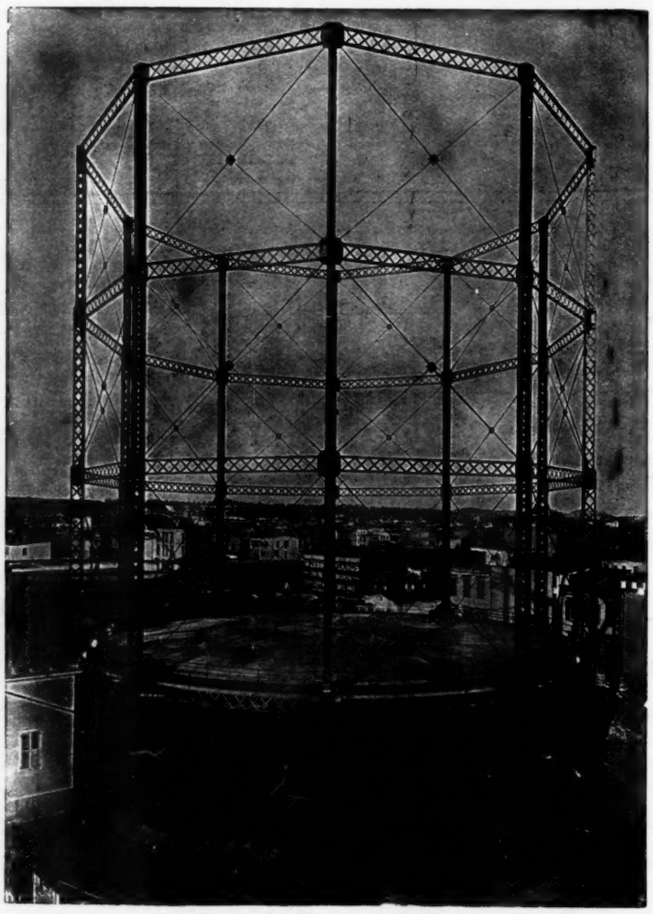

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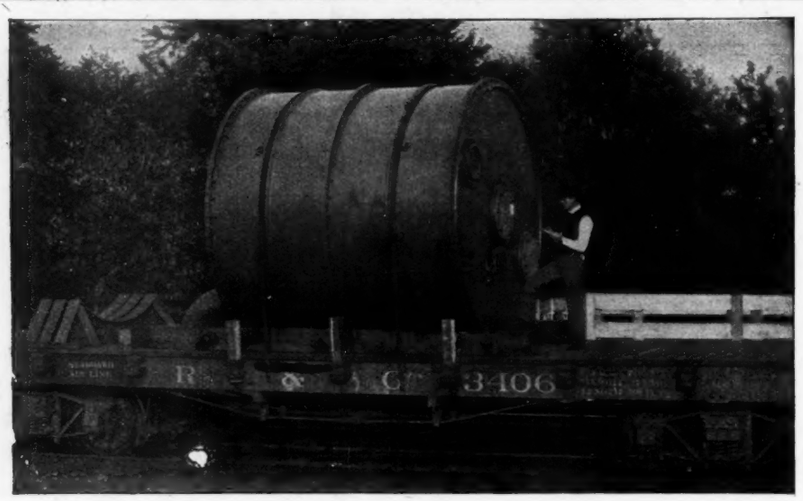

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